

62166/R

MEDICAL SOCIETY
OF LONDON



ACCESSION NUMBER

PRESS MARK

BLUMENBACH, J.F.

ELEMENTS
OF
NATURAL HISTORY.

A MEDICAL SOCIETY
MANUAL

OF THE

ELEMENTS

OF

NATURAL HISTORY.

BY

I. F. BLUMENBACH,

PROFESSOR OF THE UNIVERSITY OF GOTTINGEN, AULIC COUNSELLOR,
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ROYAL ACADEMY OF SCIENCES AT PARIS, &c. &c.

TRANSLATED FROM THE TENTH GERMAN EDITION,

By R. T. GORE,

MEMBER OF THE ROYAL COLLEGE OF SURGEONS, IN LONDON, &c.

"It is, indeed, remarkable for its clear arrangement, and for the immense quantity of interesting and valuable information it contains, condensed into a small compass. It is, altogether, the best Elementary book on Natural History, in any language."

LAWRENCE'S LECTURES.

LONDON:

PRINTED FOR W. SIMPKIN & R. MARSHALL,
STATIONERS'-HALL COURT.

1825.

MANUAL
OF
THE
ROYAL
ACADEMY
OF
SCIENCE
AND
ARTS
OF
LONDON
BY
J. J. GILLMAN
F.R.S.

PRINTED BY C. SMITH, ANGEL COURT, STRAND.

BY R. T. COLE

PRINTED FOR THE ROYAL ACADEMY OF SCIENCE AND ARTS, LONDON.

THE ROYAL ACADEMY OF SCIENCE AND ARTS, LONDON.
PRINTED FOR THE ROYAL ACADEMY OF SCIENCE AND ARTS, LONDON.

PRINTED FOR W. MURKIN & SONS, LONDON.

1850.

TO

EDWARD STANLEY, ESQ.,

ASSISTANT SURGEON,

AND DEMONSTRATOR OF ANATOMY

AT

ST. BARTHOLOMEW'S HOSPITAL,

THIS VOLUME,

IS RESPECTFULLY DEDICATED,

AS A TOKEN OF ACKNOWLEDGMENT FOR NUMEROUS

INSTANCES OF KINDNESS AND FRIENDSHIP,

BY

THE TRANSLATOR.

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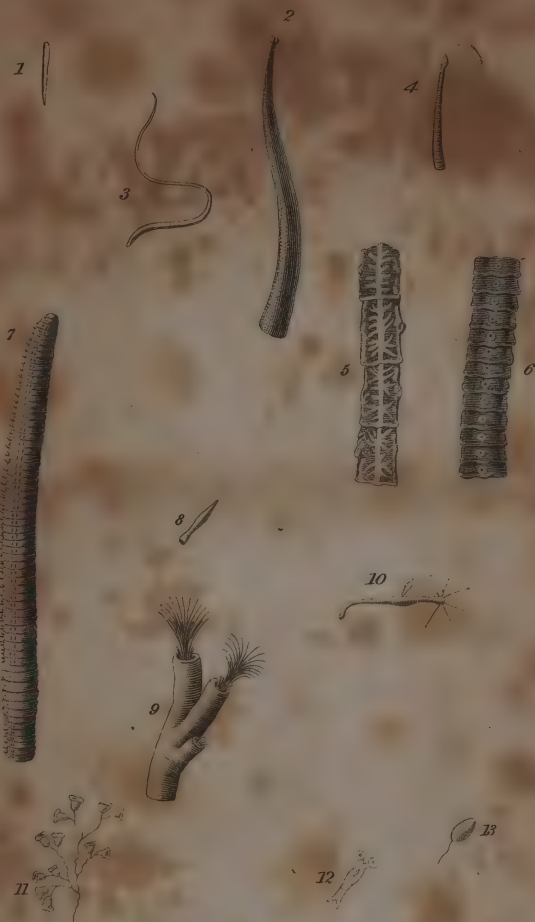
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EXTRACT FROM
THE
AUTHOR'S PREFACE.

It must not be imputed to the vanity of authorship, if I confess that I feel gratification in publishing a Tenth edition (not reckoning three re-impressions) of this Manual, which has also been translated into various Foreign languages, and in, a word, has received the approbation of the public.

Its object is to present an intelligible view of Natural History at large, as well as of its Philosophy; and from amongst the infinite number of individual objects, to include so many of the most interesting and most generally useful, as are suitable to the limits of a work intended more particularly, as a text-book to Academical prælections. I have also endeavoured to render it serviceable for the purposes of reference, particularly in reading descriptions of Travels, &c.; and with this intention have formed an Index, containing some thousand Names of remarkable Natural productions.

With regard to the Names invented by modern systematic writers, for the distinction of Genera and their Species, I may remark, that however just and reasonable it is to retain appellations which have been pretty universally received, cases occur in which it becomes still more reasonable to exchange the name thus selected, for a more suitable one, if it should happen to convey an incorrect idea. I have, however, but rarely, and then only when it appeared unavoidable, availed myself of this liberty, so often misapplied at the present day, to the incumbrance of the study of Natural History. Thus, for instance, I have restored to the Armadilloes their original name, *Tatu*, as being generally known, and long since adopted by classical Zoologists; whilst, by a strange error, these

AUTHOR'S PREFACE.

nearly hairless creatures had been designated by the term *Dasyphus* (hairy-footed); a name which the ancient Greeks had, in strict conformity with Nature, assigned to the Hare Genus. For similar reasons, I call the splendid Nephrite, from New Zealand, *Punammu-stone*, its native name, under which it was first brought to us from our Antipodes, in preference to the more modern one, *Axe-stone*; because, in the great Collections of South-Sea Curiosities here and in London, I find hooks and other implements, but not axes, manufactured from this stone by the New Zealanders. So, also, I have called that Species of the Bat Genus, *Vampyre*, which really sucks the blood of sleeping animals; whilst LINNÆUS, on the contrary applied this name to the *Roussette*, which never sucks blood, and lives exclusively on fruits. Many other artificial names of the kind, I have, when not too unsuitable, allowed to remain unaltered, in order to avoid an unnecessary increase of nomenclature and synonymy, which might prove burdensome to the learner.

It is on sufficient grounds that many well known names will be found written in this work in a manner varying from the common. Thus, I employ *Tofus* and not *Tophus*, the word not being derived from the Greek: so, also, *Manacanite* and not *Menacanite*.

In the Animal Kingdom I have always prefixed the Latin name, because many hundred foreign creatures occur, which have not any common or well known appellation in our language. The case is different in the Mineral Kingdom: there the German names are those most universally known, and have, even in many instances, been incorporated into other languages.

The representations of objects of Natural History, (*Abbildungen Natur-Historischer Gegenstände*) which I publish in Fasciculi, bear reference to the latest Editions of this Manual, and are well calculated for the purpose of illustrating it.

I. F. BLUM ENBACH.

Göttingen, August, 1820.

ADVERTISEMENT

BY THE TRANSLATOR.

THE intrinsic merits of this Manual, together with the reputation of PROFESSOR BLUMENBACH, and the favourable reception it has received in other countries, will, probably, be considered as a sufficient apology for presenting it to the English public. Without attempting to anticipate or evade the criticism to which he may have exposed himself, the Translator is far from supposing that he has been so fortunate as to succeed in avoiding the defects generally attendant on an undertaking like the present: with regard, however, to the language and construction, points for which he is more particularly answerable, he may perhaps be allowed to advert to; first, the peculiarities of the German language; and, second, the nature of the work, which affords no opportunity for ornament, and in which it is necessary that every thing should be subservient to the important particulars of clearness and utility.

To prevent the disappointment which might be created by erroneous impressions, it should not be forgotten that this book is solely what it professes to be, a Manual, and that it is as little calculated as intended to answer the objects of a systematic work on Natural History.

It is in a few, and, for the most part, unimportant instances, that the Translator has felt himself justified in making any alterations; in this respect he has almost wholly confined himself to the correction of errors arising from the imperfect acquaintance of the Author with the English language. In the Natural History of the Mineral Kingdom, PROFESSOR BLUMENBACH has, for the most

ADVERTISEMENT.

part, mentioned the German localities only, of the various Minerals described. To those who might think that the deficiency should have been supplied, as far as regards our own country, it may be sufficient to mention, that such an undertaking, besides adding materially to the length of the work, would have rendered some changes in the arrangement necessary, and did not appear altogether essential in a work which, as already stated, lays no claim to the rank of a systematic one.

Bath, August 1st. 1825.

SECTION I.

OF NATURAL BODIES IN GENERAL, AND OF THEIR DIVISION INTO THREE KINGDOMS.

§ 1. ALL bodies which we meet with upon the surface, or in the interior of our planet, present themselves either with the form and structure which they receive from the hands of the Creator, and from the undisturbed action of the powers of Nature; or else, with changes and alterations resulting from the designed actions of men and beasts, or from the effects of mere accident.

On this difference is founded the familiar division of them into *natural* and *artificial*. The first form the object of Natural History, and comprise all those bodies in which *man has not effected any essential alteration*. On the contrary, artificial bodies are those in which changes have been *designedly* produced by the hand of man*.

Remark 1st. It is unnecessary to say, that the ideas attached to the terms *essential* and *designed*, are susceptible of such varied views and modifications, as to be merely relative. Thus, in certain respects, a *mule*, or a *Carib*, with his *artificially moulded skull*, and other instances of the same kind, might be included among *artificial bodies*.

Remark 2d. In some cases *natural bodies* have such a close resemblance to the products of art, that it is difficult to distinguish one from the other class. Hence, for example, the great diversity of opinion which formerly prevailed as to whether the superficial layer in the *piscina mirabile* near Baiæ, was a natural deposit of calcareous tufa

* “*Ars, sive additus rebus homo.*”—BACON. *De Augment. Scientiarum*, Lib. 2.

“L’Art en général est l’industrie de l’homme appliquée par ses besoins ou par son luxe aux productions de la Nature.”—DIDEROT. *Système figuré des Connoissances humaines*.

from water, or an artificial coating purposely laid on.
(Vide *Göttingen Gelehrt. Anzeigen*, 1791. p. 188.)

§ 2. Natural bodies differ among themselves with respect to, 1st, their Origin; 2d, their Growth; and, 3d, their Structure.

Some of them are invariably produced by other bodies of the same form and kind; so that their existence in an unbroken series, up to the first Creation*, presupposes other similar bodies, to which they owe their being.

In the *second* place, they introduce various extraneous substances into their bodies as nutriment, assimilate them to their own composition, separate the superfluous parts, and by this constant change and renewal grow *from within*—by *intus-susceptio*.

Thirdly, The existence of these two properties presupposes a peculiar *structure* in this class of Natural Bodies. For, in order to introduce and to assimilate nutriment, and at a future period to produce other creatures of their own kind, it is necessary that their bodies should be provided with vessels and other organs, suitably connected, endowed with (so called) *vital powers*, and adapted to the reception of certain fluids, the assimilation of aliments, and the procreation of progeny.

All this is wanting in natural bodies of the other class, viz. in Minerals. Both origin and growth in them (if they can be said to grow), are the effects not of nutrition, but simply of, so called, physical (chemical and mechanical) laws—of aggregation, the addition of homogeneous particles *from without*; consequently, neither organization nor vital forces are to be expected.

The latter are therefore called *inorganic*, and the former *organized* bodies.

§ 3. Farther, organized bodies also differ, particularly with respect to the manner in which their nutriment is introduced.

Some of them absorb a very simple nutritious fluid, principally by means of numerous fibres placed at the lower part of their bodies, without any evident spontaneous motion.

* Or at least to their first progenitors;—for in the first part of my *Contributions to Natural History* (*Beyträge zur Natur-Geschichte*), I have adduced facts rendering it more than probable, that even in the present Creation, new species of organized bodies arise. To such subsequent operations the first origin of many simple and microscopic beings appears referable; such, for instance, as the greater number of the *Animalculæ Infusoriæ*.

The others, on the contrary, have a simple opening at their upper or anterior extremity, leading to a capacious bag, into which, when impelled by hunger, they introduce their food, (which is of several kinds,) by means of voluntary motion.

The former are *Plants*, the latter *Animals*.

Remark. The power of locomotion does not afford any sufficiently precise character of distinction between Animals and Plants. Many plants, common *Duckweed*, for example, are not firmly attached to the ground by their roots, but can change their situations at certain seasons of the year, &c., sinking at one time to the bottom, and at others coming to the surface of the water. On the other hand, there are whole *genera* of aquatic animals, especially among the *testacea* and *corals*, which are incapable of changing the spot to which they have once attached themselves.

§ 4. This easily intelligible division of natural bodies into organized and inorganic, (§ 2.) and that of organic bodies, (§ 3.) is the basis of the three kingdoms, in which they have been very conveniently classed, and of which, the first includes Animals, the second Plants, and the third Minerals.

Animals, therefore, are organized bodies, living and animated, seeking their food, which may be of various kinds, by voluntary motions, and introducing it, by a mouth, into a stomach.

Plants are also organized bodies, living, but not animated, absorbing their very simple, nutritive fluids by roots, and without the aid of voluntary motion.

Minerals, lastly, are inorganic bodies; not living, consequently without vital powers, and governed merely by the physical (mechanical and chemical) principles of attraction, affinity, plastic force, &c.

Remark. Two objections have been made, particularly in modern times, to this division into three kingdoms.

Many have admitted the distinction between organized and inorganic bodies, but have denied the existence of any well defined limits between Animals and Plants.

Others have carried the favourite metaphor of gradation in the Creation to such an extent, as to exclude the division of Nature into kingdoms.

As to the first, what often happens with respect to objects of experience should not be forgotten, namely, that

it is easier to know things as they *really exist* *, than to discover and to indicate their distinctive characters †. Thus Linnæus said—" *Nullum characterem hactenus eruere potui, unde Homo a Simia internoscatur.*"—Now I believe, that in this very work I have established such characters, by means of which Man can be unerringly distinguished from the most anthropomorphous Ape, as well as from all other Mammifera. But even without them, it is to be hoped that no Naturalist would incur any risk, *in praxi*, of confounding a Man with an Ape. Still more, creatures from very different classes have frequently remarkable and unexpected resemblances to each other, without, on that account, doing away with the indisputable differences between the classes to which they belong. For example, animals are very correctly divided into warm-blooded and cold-blooded; with equal propriety Mammifera are reckoned among the former, and Insects among the latter; yet it is not on that account less true that Bees, in their hive, are, beyond comparison, warmer than a Hedgehog during his hybernation. So also, there are genera in the class Vermes, such as that of Sepia, (cuttle-fish) which differ from other animals of that class, and are very similar to fishes. But no one will conclude, that therefore the separation of the class Pisces from the class Vermes should be rejected. With as little propriety can the animal and vegetable kingdoms be confounded together, merely because a certain similarity of certain plants to certain animals, has been remarked. Of this kind are the singular motions of several *mimosæ*, of the *hedysarum gyrans*, &c., which, remarkable as they may be, do not, in any respect, assume the character of animality which has been already laid down. As little of the character of vegetability have the resemblances of the arm-polypi with plants. These polypi

* In the common acceptation of the term; for it is needless to say, that, in a stricter sense, we know only the *appearances* of things.—" *Videmus enim, omnes rationes, quibus natura explicari solet, modos esse tantummodo imaginandi, nec ullius rei naturam, sed tantum imaginationis constitutionem indicare.*"—SPINOZA.

† "Facilius plerumque est rem præsentem discernere, quam verbis exacte definire."—GAUBIUS.

"The obscurity lies not in the nature of the grounds of distinction, which actually exist, but rather in the difficulty of detecting them in particular instances."—J. AUG. UNZER.

are animals, which, alike with man and the oyster, impelled by hunger, introduce food into their mouths by voluntary motions, a thing which does not take place in any plant in the known creation.

It is equally easy to give an answer to the other objection to the three kingdoms of Nature, founded on the common metaphor of a scale of beings.

All these ideas of chain, scale, progression, &c., in Nature, are so far useful in the methodical part of the study of Natural History, as they form the basis of a (so called) *Natural System*, in which beings are classed according to their most striking resemblances, their general habits, and the mutual affinities derived from those sources.

But to do, as some well-meaning Physico-Theologians have done—to make this a part of the plan of the Creation, and to look there for the unity and perfection of that Creation, on the principle that there are not any abrupt transitions in Nature (such is the expression), *because* beings form a series as regards their external forms, appears to me to be at least presumptuous, even if it were not, as it actually is, in contradiction with itself when closely examined*.

In truth, it is only necessary to inspect this ingenious, but artificial, scheme of a regular gradation of beings, to discover that on the one hand immense numbers of creatures of similar form are collected into genera, composed of almost innumerable species (particularly among worms and insects, and also in the vegetable kingdom), whilst others, on the contrary, stand as it were isolated; because, on account of their very distinct and peculiar forms, they cannot, without violence, be introduced into any part of such a gradation of natural objects. Such, for example, is the whole class of birds, tortoises, the sepia, already mentioned, and others. More than this, there are animals (among insects the genus *coccus*,) in which the forms of the male and female are so different, that in such a scale it would be absolutely necessary to separate the two sexes, and to assign them very distant situations in the series. Besides all this, there are positive interruptions in the scale, which it is impossible to pass over without abrupt

* Vide *Beyträge zur Natur-Geschichte*. 1 Th. p. 106. &c.

transitions ; as in one instance out of many, that between organized bodies and minerals.

If this suppositious gradation in Nature is to be considered as defective, equally groundless is the idea advanced by some Physico-Theologians, that if one link of their hypothetical chain should be lost, the whole course of the Universe would be interrupted, &c. But as whole species of animals have been exterminated in large islands (wolves, for instance, in England), without any interruption of the completeness or connexion of the remaining Creation in those spots ; so also, others may disappear from the entire surface of the globe, (as seems to have happened in many cases already, the *dodo*, *didus ineptus*, for instance,) without any disturbance in the regular and eternal unity of the Creation succeeding to this evident *hiatus* in the physico-theological chain.

*List of Authorities and Sources of Reference for
Natural History in General.*

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SECT. II.

OF ORGANIZED BODIES IN GENERAL.

§ 5. Organized Bodies (§ 2.) are, in general, *produced* by their like *; their *existence* and their *growth* are the effects of a peculiar power lasting during life, and by which they are also enabled, when arrived at maturity, to continue the species.

§ 6. They are rendered capable of performing these important *functions*, by the *organization* of their *structure*, and by the *vital powers* connected with it. For it is by means of the latter that the *organs* receive as well their *sensibility* to impressions, (*stimuli*,) as their *powers of motion*, without both of which it would be impossible to conceive either *nutrition* or *growth*, or the mutual influences of parts for the support of the whole, and the contrary †.

§ 7. In order to explain the formation of organized bodies, the hypothesis of evolution has been advanced, particularly in modern times. According to it, neither human beings, nor other animals, nor plants are *generated*, but all have existed from the first creation as *perfect, pre-formed germs* ‡, within their *ancestors*, the succeeding generations being lodged in the preceding ones like nests of boxes, and progressively developed, and brought to light by the process of impregnation; an idea which, even if it were not most decisively contradicted

* See the Note at page 2, above.

† Compare KANT's *Critik der Urtheilskraft*, p. 285, &c.

‡ "For," says Haller, the head of the modern Evolutionists, "all the viscera, and even the bones, already exist in an invisible germ, although in an almost fluid state."—This is at least a positive expression.

But when some modern writers, endeavouring to reconcile the hypothesis of evolution, with the doctrine of progressive formation, admit that the seminal fluid is not pre-formed, and yet assert that it contains a germ, which differs from the unorganized fluid, they employ vague unmeaning terms. At least, I may use the same language in relation to these QUASI-germs, as Cicero did when speaking of the *quasi corpus* of the God of the Epicureans;—*Corpus quid sit, intelligo: quasi corpus quid sit, nullo prorsus modo intelligo.*"

by the results of experience, must be considered as inconsonant with every principle of unbiassed reason, as well from the interposition of preternatural (hyper-physical) arrangements (Vide KANT. *Op. Cit.* p. 372.), which it renders necessary, as from (contrary to all the rules of the philosophical study of Nature,) the uncalled for multiplication of natural (physical) powers, and from the incalculable number of creations without any object, consisting in the multitude of pre-formed germs, which can never have even an opportunity of development.

Remark. The most able and zealous advocates of the hypothesis of evolution agree in supposing that the pre-formed germs exist in the female, and that during the process of fecundation they are stimulated and excited to development by the power of the seminal matter of the male. What is called impregnation, is with them nothing more than the excitement of the dormant germ by the stimulus of the male semen.

Here, consequently, an exciting power is first of all required. But in many instances children resemble the *father only*. Bitches, which have copulated with several dogs at short intervals, often produce whelps similar to the different males. Human beings of two separate races, such as the White and the Negro, produce children intermediate between them, viz. Mulattoes. Lastly, when impregnation takes place between two dissimilar species of animals or plants, bastards are produced, bearing an equal degree of resemblance to the forms of the male and female.

These are facts which it is impossible to mistake; consequently, besides its exciting power, the evolutionists admit the existence of a *formative* power in the male semen, to such an extent as to enable it to *modify* the form of the germ pre-existing in the female, and to approximate it to that of the male.

On this supposition then, the male semen must possess two powers; 1st, an exciting; and, 2d, a formative power. But it is possible, by the artificial production of a bastard progeny, for several generations, completely to change one species of organized bodies into another. For instance, fertile bastards have been obtained by the artificial impregnation of one species of plants with the pollen of another; these again, when fecundated by the same pollen,

produced a second generation of fertile bastards. The bastards of the first generation were intermediate between the two original species. Those of the second, on the contrary, more closely resembled the male, from which the pollen was taken, than the female; and by continuing a similar artificial impregnation through two other generations, plants were ultimately produced in which the original form of the female had wholly disappeared, and was changed to that of the male. (Vide J. KÖLREUTER's third Appendix to an Account of some Experiments relative to the sexes of Plants, p. 51. § 24. under the title of "Complete Conversion of one natural species of Plants into another.")

The pre-formation of the germ from the Creation must therefore have proved unavailing, and must have given way to the formative power of the male semen, which, according to the hypothesis of evolution, should have exerted merely an exciting influence upon it.

§ 8. Hence also, it is far more consonant with the powers of our understanding, and with the rules of the philosophical study of Nature *, to explain the origin of organized bodies by the *progressive formation* (epigenesis) of the seminal matter, itself unorganized, but susceptible of organization in certain circumstances. But on account of the various modes † which can be, and have been adopted, of explaining such a progressive formation, it is necessary to define it in such a way as to make it correspond as closely as possible with the ideas entertained of organized bodies, and with the phenomena presented to our notice by the observation of their origin.

§ 9. This may be done by admitting, that the mature and previously *unorganized*, but *organizable*, seminal matter of the progenitors, when transmitted at the proper time, and under certain

* "Causas rerum naturalium non plures admitti debere, quam quæ et veræ sint et earum phænomenis explicandis sufficient."—is the first of NEWTON's *Regulæ Philosophandi*.

† For when Mazini, for instance, supposed that the progeny was formed at its conception by a kind of crystallization, this also was a species of epigenesis.

But the utter inadmissibility of all such mechanical expositions of the progressive formation of organized bodies, by what the ancients called *Vis Plastica*, which prevails also in the Mineral Kingdom, is shewn by the notions entertained of organized bodies, which always suppose a destination to the effecting of fixed objects.—See also KANT, *op. Citat.* p. 292.

necessary circumstances, to the place of its destination, comes under the influence of a *vital power*, the so called *Formative Impulse*, (*Nisus Formativus*, *Bildungstrieb*,) which gives origin to suitable actions. This *impulse* is distinguished from all purely mechanical *formative powers* (such as that which produces crystallizations, &c. in the mineral kingdom *), by its capability of moulding the varied kinds of organizable seminal matter by an infinite number of modifications into forms corresponding to, and equally numerous with the endless differences in the purposes which organized bodies and their parts are destined to fulfil. The combination of the mechanical principle with this, which is susceptible of modifications subservient to particular objects †, operates, first, in producing the *progressive formation* from the time of conception; second, the support of the structure thus formed, by *nutrition* during life; and, lastly, as far as is possible, repairs, by the process of *reproduction*, the accidental injuries it may experience ‡.

Remark 1st. This progressive formation of new organized bodies can be most easily observed in those which, together with a tolerable size, and a very rapid growth, possess a structure so delicate and transparent, as to permit us to see through them readily, in a moderate light, and with a slight magnifying power.

Such are, in the vegetable kingdoms, many simple water-mosses; as, for example, *conferva fontinalis*, (*ceranium cæspitosum*) which propagates in the first days of spring.

Among bloodless animals, the arm-polypi.

And in warm-blooded animals, the first appearance of

* Crystallizations may be discriminated from organized bodies merely by the geometrical regularity of their almost invariably rectilinear outlines, which are reducible to a few primary forms: the bodies of animals and plants on the contrary must, in order to render them suitable to their destined offices, be moulded into an incalculable number of forms with endlessly varied outlines.

† Comparative Anatomy affords numerous and striking examples (many of which I have noticed in my Manual of that Science) of this connexion of the two principles, mechanical and *teleological*, which has hitherto been considered as impracticable in affording an explanation of the mode in which organized bodies originate: this combination forms the most striking characteristic of the doctrine of the Formative Impulse. (*Nisus Formativus*.)

‡ I have entered more fully into the consideration of this subject in the third edition of my Treatise.—*Ueber den Bildungstrieb* Göttingen, 1791. 8vo.

the chick in the incubated egg, and its subsequent progressive formation from day to day.

Remark 2d. I trust that it is unnecessary to inform the greater part of my readers, that the term *Formative Impulse*, like the names applied to every other kind of vital power, of itself, explains nothing; it serves merely to designate a peculiar power formed by the combination of the mechanical principle with that which is susceptible of modification; a power, the constant agency of which we ascertain by experience, whilst its cause, like that of all other generally recognized natural powers, still remains, in the strictest sense of the word—" *qualitas occulta* *." This, however, in no way prevents us from endeavouring, by means of observation, to trace and explain the effects, and to reduce them to general principles.

§ 10. The *Formative Impulse* acting in a determinate manner, and with a particular object, upon given materials susceptible of its influence and of organization, preserves the equally determinate form and habit of all the individual species of organized beings: by the same influence the sexual difference, in other words, the distinction of males from females in the same species, when such a difference exists, is established.

§ 11. But the *formative impulse*, like every other vital power, may deviate from its peculiar determinate direction in various ways, when disturbed in its action or modified by extraneous circumstances †.

From this source arise, (passing over those deviations which are the effect of disease, as not coming within the sphere of Natural History) 1st, from material disturbances of the power, organized bodies with preternatural ‡ forms, viz. *Monsters*;

* "Il fallait respecter les *qualités occultes*; car depuis le brin d'herbe que l'ambre attira, jusqu'à la route que tant d'astres suivent dans l'espace: depuis la formation d'une mite dans un fromage jusqu'à la Galaxie; soit que vous considériez une pierre qui tombe, soit que vous suiviez le cours d'une comète traversant les cieux, tout est *qualité occulte*."
—VOLTAIRE.

† I have treated more at length of these deviations in a "*Commentatio de anomalis et vitiosis quibusdam Nisus Formativi aberrationibus*. Gött., 1813, 4to."

‡ Preternatural only in the common acceptation of the term. We have been advised to say *unusual*, and not *preternatural*; the two words, how-

2d. From the more or less perfect combination, in one individual, of the double sexual characters commonly distinct in the two sexes—*Hermaphrodites* ;

3d. From fecundation taking place between two beings of different species—*Bastards* ; And

4th. By the action of the various causes of gradual degeneration—*Races* and *Varieties*.

§ 12. By the term Monster, as it is commonly employed, is meant a preternatural, congenital, and striking deformity of external and considerable parts. However varied these deformities may be, they may be classed under the four following heads * :—

1st. Monsters with preternatural formation of individual parts. *Fabrica aliena*.

2d. Monsters with transposition or preternatural situation of individual parts. *Situs mutatus*. (The rarest of all—at least according to the definition given above. In many instances the viscera of individuals apparently well formed, have been found, on dissection, completely transposed.)

3d. Monsters in which entire parts are wanting. *Monstra per defectum*. The most instructive of all.

4th. Monsters with superfluous parts. *Monstra per excessum*. The most frequent ; not uncommon even among wild animals, the hare for instance. In some degree, also, hereditary, as in the six-fingered families, and in fowls with five or six toes.

Remark. The decided similarity of many kinds of monstrosity proves, that even these deviations of the *Formative Impulse* must be regulated by certain laws ; whilst, on the other hand, the well known fact that they are much more frequent among cultivated plants and domesticated animals †, than in those which still remain in a state of nature, is strongly opposed to the doctrine of the Evolutionists, that the germs of such monsters were also monstrous, and were pre-formed from the Creation.

ever, convey distinct ideas, and their indiscriminate application, though not *unusual*, is certainly very far from being *natural*.

* See, in my *Abbildungen Natur-Historischer Gegenstände*, Tab. 61, a young pig's head, from my Collection, in which all four kinds of deformity are combined.

† For instance, Monstrosities are particularly frequent in the domestic swine ; in the wild kind they are almost unknown.

§ 13. Those individuals only are called *hermaphrodites*, in a strict sense of the word, in which are more or less perfectly combined in a preternatural manner, traces of the two distinct kinds of sexual organs, which are ordinarily separate in the male and female of the same species. Such are sometimes met with even in warm-blooded animals, particularly oxen, sheep, and goats.

In this place that deviation of the *Formative Impulse* deserves notice, in which functions or characters, commonly peculiar to one sex, are manifested by individuals of the other. Of this kind is the growth of horns in Hinds and Roes; the acquisition of the male plumage by the pea hen and hen pheasant, as they become old; the secretion of milk in men and other male mammifera*.

Lastly, we occasionally observe more or less of the appearance and habit of the one sex, in the condition and form of individuals of the other, without any farther deviation from regularity and perfection; as, for instance, a feminine delicacy in the whole form of the male†.

§ 14. When a female of one species is impregnated by a male of another, *bastards* are produced, the forms of which are as it were compounded of those of their progenitors‡. But as the perfect execution of the functions of organized bodies, and of animals in particular, essential as it is to the whole scheme of Creation, depends upon their determinate forms, it has been wisely provided by Nature; first, that in red-blooded animals at least, two distinct species are never, to the best of my knowledge, observed to copulate and breed whilst in a state of nature; secondly, that the bastard progeny is for the most part barren, and very rarely capable of propagating. To this there are a few exceptions, in those instances in which the mule and the bastards between the linnet and canary bird are fruitful. In plants, it is much easier by means of the artificial impregnation of distinct species to procure bastards bearing

* I have treated on this anomaly in the *Hanover Magazine*, 1787. p. 753.

† See more on this subject in my *Specimen Historiæ Naturalis antiquæ artis operibus illustratæ eaque vicissim illustrantis*.—Gött. 1808, 4to. page 14, &c.

‡ Mongrels, on the contrary, are those beings produced by the combination of progenitors not *specifically* distinct, but merely forming two different races of the same species: thus are formed in the human species, for instance, mulattoes, &c.

fertile seeds. (See page 8, above.) The fabulous tales of the supposed bastards from the copulation of oxen with the horse or ass, of rabbits with the common fowls, and even of man with beasts, do not need contradiction.

§ 15. Races and Varieties are deviations from the original specific forms of individual species of organized bodies, resulting from their gradual variation or degeneration.

The word race, however, is in strictness applicable only to a character produced by degeneration *, and of such a nature as to become by propagation necessarily and inevitably hereditary; as, for example, when whites produce mulattoes with negroes, or mestizoes with American Indians; on the contrary, this is by no means a necessary consequence with respect to varieties; as, for instance, when fair individuals produce with brunettes dark-eyed children †.

Remark. When particular deviations have been continued through a long series of generations, it often becomes difficult to decide whether they are races merely, or originally distinct species. To assist us in forming a determination in such cases, there are no rules applicable in practice but those drawn from analogy; the proposal of Ray, Buffon, and others, to fix the character of a species by the possibility of producing a fruitful progeny, is uncertain and inadequate to the object proposed. For, not to mention, that this rule is inapplicable in all those animals and plants which propagate without copulation, (see § 20, below) its adoption is prevented in very many other cases by insurmountable difficulties, as in the instance of the question, whether the Asiatic and the African elephant belong to the same species or not. And even when we have the assistance of experience, as in the copulation of the horse and ass, which should be considered as the rule, the ordinary or the extraordinary result? Commonly mules are barren, and it is only in some rare instances that they have been found capable of propagation. But if this singularly rare occurrence be adopted as the rule, the horse

* It is right to remark, that the word "degeneration," is here employed in its literal meaning, to express a deviation in breeding from any given standard, without any reference to inferiority or superiority.—TRANSLATOR.

† This distinction between Races and Varieties was first established by KANT, in the *German Mercury*, 1788. Vol. I. p. 48. See also, GIRTANNER, *Ueber das Kantische Princip. für die Natur-Geschichte*. Göttingen, 1797. 8vo.

and ass must be considered as animals of the same species, although in their whole structure, particularly internal, as, for instance, in the strikingly different disposition of their vocal organs they vary specifically, at least as much as the lion and the cat. All analogy is in favour of their separation into two distinct species; and, in like manner, I consider myself justified by the same principle of analogy, to form the elephants already mentioned into separate species, because of the constant and remarkable differences presented by their teeth, which cannot be imagined to be a mere effect of degeneration.

§ 16. Among the many causes of degeneration, the principal are the influence of climate and of food; and in man and animals, the mode of life.

A cold climate, for example, interrupts the growth of organized bodies; hence the Greenlanders, Laplanders, &c., together with the animals and plants of cold regions, are small and short. So also this climate gives a white colour to its animals and plants; for the same reason the northern nations have white skins, &c., many animals of cold regions anomalous white hair and feathers, many plants anomalous white blossoms, &c. On the other hand, Creoles, *i. e.* whites born in the East and West Indies, of European parents, bear the mark of their southern origin in a manner that cannot be mistaken.

We witness the most evident specimens of the power of different modes of life, culture, and food, to change, by degrees, the form, colour, and entire constitution of organized bodies, in our domestic animals *, our grain, our fruits, garden plants, and flowers, but above all, in the human species itself.

These various causes of degeneration may, according to circumstances, either mutually co-operate, and thus render the deviation more rapid and more remarkable, or they may, to a certain extent, act in opposition one to the other; hence, in the one application of the principles to individual cases, we must guard against forming an opinion too decidedly.

Remark 1st. Thus there are, even under the line, cold districts, as the interior of Sumatra, &c. Siberia, on the other hand, produces many plants of warm climates, which do not appear in much more southerly regions of Europe.

Remark 2d. The peculiar effect which some climates produce

* See on the Races of Men and the Races of Swine.—VOIGT's *Magazine*, Vol. VI. Part 1, p. 1., &c.

on organized bodies, particularly animals, is very singular. In Syria, for example, the cats, rabbits, and goats, have extraordinarily long white hair; in Corsica, the horses and dogs are spotted in a peculiar manner; in Guinea, the men, dogs, and fowls, become negroes in their different ways.

§ 17. The nutrition of organized bodies is effected in different ways. Plants derive their support from their roots, which are *external*, and placed at one extremity of the stem. Animals, on the contrary, as was remarked by Boerhaave, have their roots *within* their bodies, viz. in the stomach and intestines, where the nutritious portions of their food are absorbed by numerous vessels, analogous in their office to the roots of plants, and carried to every part of the body.

The serviceable part of the alimentary matter is assimilated to the materials of organized bodies by a truly wonderful process; the superfluous portion is rejected by perspiration from the surface, and in animals, of which the nutritious fluid is less simple than that of plants, is also thrown off in other ways under the form of excrement.

§ 18. *The growth* of organized bodies is the consequence of nutrition. The greater number arrive early at their destined size. There are, however, some trees, such as the Norfolk island pine, (*Columnia pinifolia*, or *Auracaria excelsa*) the *Areca oleracea*, the *Baobab*, (*Adansonia digitata*) some other plants, as the *Rotang*, (*Calamus Rotang*) and even some animals, as, for instance, many species of *tœnia*, crocodiles, and water-serpents, of which it is difficult to say, whether, or at what period, they cease to increase in length and thickness.

§ 19. To the growth of organized bodies belongs, also, their power of reproduction, or the peculiar property by which mutilated or completely separated parts are regenerated. This wonderful disposition in the organized creation ensures the preservation of animals and plants, in the many accidents to which they are liable: consequently it, together with the power of nutrition, forms a decided evidence of the superiority of the machines constructed by the Creator over the most perfect productions of human art, to which it is impossible to impart the power of remedying the defects arising from the disturbance, injury, or usage of the wheels and springs entering into their composition; this power has, however, been allotted in very different degrees, to different animals and plants.

Many organized bodies lose, at fixed periods, and without any external cause, certain parts of their bodies, which are subsequently reproduced; to this head belong the casting of horns, the moulting of birds, the change of the skin in snakes and caterpillars, of the shell in crabs, and of the leaves in plants. This we may call *ordinary* reproduction.

The other kind is the *extra-ordinary*, to which I allude more particularly, and by means of which, especially among animals, wounds, fractures, &c., are cured; and parts which have been accidentally mutilated or destroyed, are regenerated. This power is but limited in man, and in the animals most closely related to him: on the contrary, in many cold-blooded animals, particularly water-newts, crabs, snails, earth-worms, sea anemones, sea-stars, arm-polypi, it exists in great strength and perfection.

Remark. Many years ago I extirpated almost the whole eye of a water-newt of the larger kind (*Iacerta palustris*), and which I still preserve in spirits; all the humours were evacuated, and four-fifths of the membranes cut away; notwithstanding which, within ten months a perfect new eye was formed, with cornea, pupil, lens, &c., and only differing from the eye on the other side, in being about half its size. (See *Götting. Gel. Anzeig.* 1785. p. 47.)

§ 20. When organized bodies have, by nutrition and growth, arrived at maturity, they then also acquire the faculty of *procreation* (§ 5.), a faculty, however, which is exercised in very different ways. For, either each individual is *singly* capable of continuing the species; or else, the production of new beings is effected by the copulation of two distinct individuals.

The numerous variations of these two principal methods of propagation, may be conveniently ranged under the four following classes:—

1st. Every individual multiplies itself in the most simple manner, without previous impregnation; either by *division*, as many infusory animalculæ* and blossom polypes†; or, as in the *conferva fontinalis*, by the enlargement of one end of the old thread-like plant into a globular ball, which afterwards falls off and itself expands into a thread of the same kind; (See

* J. ELLIS in the *Philosophical Transactions*, Vol. LIX. Part I. page 138. plate 6. figs. 1 and 6.

† A. TREMBLEY in the same Work, Vol. XLIII. page 175, &c., and Vol. XLIV. page 138, &c.

Abbild. Nat. Hist. Gegenst. Tab. 49.) or by sprouts, as the arm-polypi and many other plants.

2d. Each individual is capable of propagating singly ; but is a true hermaphrodite possessing two kinds of sexual organs ; previous, therefore, to the production of young, it must itself be impregnated ; if it be an animal, the female ova by the male semen ; and if a plant, the female germen by the male pollen. This is the case with most plants ; and in the animal kingdom, apparently, with many shell-fish.

3d. Both sexes are, as in the hermaphrodites of the previous class, combined in one individual ; no *one*, however, is capable of impregnating itself ; but two must copulate, mutually impregnating and being impregnated. This singular disposition occurs only in a few animals ; in the earth-worm, many land snails, &c*.

4th. The two sexes are placed in separate individuals, of which one contains the female parts or ovaria, the other the male fecundating fluid. Such are all red-blooded, and many other animals ; such, also, are several plants, as palms, the hop, and most mosses.

Some animals of this class deposit the ova, in which the formation of the young is subsequently completed : these are *oviparous* animals. In others, the ovum is retained in the womb until the young is perfected, and can enter the world without its appendages ; *viviparous* animals.

Remark. Quæ actu animal pariunt, vivipara dicuntur ; quæ potentia, ovipara.—HARVEY.

How little essential difference there is between oviparous and viviparous production, is proved by the instances of the plant-louse, (*aphis*) and plumed polype, which, according to the season of the year, produce some times in the one way, sometimes in the other ; and many serpents which lay eggs containing the young animal completely formed. With this last example, may be in some sort compared those plants, the ripe seeds of which inclose a green shoot ; for example, the Egyptian beans, as they are called, of the *nymphæa nelumbo*.

§ 21. When organized bodies have accomplished the objects of their lives, all vital power ceases, and they *die*. Few, however, reach the limits set by Nature to the duration of their

* SWAMMERDAM.—*Biblia Naturæ*, page 157.—Tab. 8. fig. 6.

life, a thousand accidents interrupting its course long before the destined time. Thus, it is supposed, that of one thousand men born, seventy-eight only die of old age ; and of the large amphibia, the crocodile, the boa, &c., probably not one in a thousand reaches its full age and bulk. After the death of animals and plants, their bodies are gradually destroyed by fermentation, putrefaction, and the chemical affinities of their elements, their internal organization is destroyed, and their remains are ultimately confounded with that earth from which they had once derived nourishment and support.

For the Natural History of Organized Bodies generally.

CH. BONNET.—*Considerations sur les corps organisés.* In the 3d Vol. of his Works.

G. R. TREVIRANUS.—*Biologie, &c.* Gött. 1802. *et seq.* 8vo.

SECT. III.

OF ANIMALS IN GENERAL.

§ 22. Endlessly varied as are the form and structure of animals, they appear to have in common, with at most a few exceptions, among the infusory animalculæ, a *mouth* (§ 3.) through which they introduce their food ; and whilst plants absorb their simple nutriment from air, water, and earth, the food of animals is of many kinds, and, almost without exception, derived from the organized kingdoms ; impelled, too, by the painful *feeling of hunger*, they are obliged to seek it by means of *voluntary motion*, for the purpose of preserving their existence.

§ 23. In the more perfect animals, as they are called, the nutritive fluid is first mixed with the blood circulating in their vessels, and then deposited from it, in the component parts of their bodies. The *blood*, properly so called, is of a red colour, but differs with regard to its temperature in the different classes of *red-blooded* animals. In one class, viz. amphibia

and fishes, it commonly approaches to the temperature of the medium in which they are placed ; hence they are called *cold-blooded*. In the other, therefore, called *warm-blooded*, (mammalia and birds) it possesses a degree of heat about 100° Fahr., more or less. The fluid which, in the so called *white-blooded* animals, (insects and worms) supplies the place of blood properly so called, is distinguished from it more particularly by the absence of red globules.

§ 24. The blood of animals, whether it be white or red, hot or cold, must, in a state of health, be constantly supplied, either from the atmospheric air, or from water, with successive quantities of a substance necessary for the continuance of life (oxygen) ; giving off, in return, equal quantities of another, (carbon.) This remarkable process is principally effected in the living animal laboratory by means of *respiration* ; a function which red-blooded animals perform either by *lungs*, or like fishes, by means of *gills* ; and white-blooded, by a variety of analogous organs.

§ 25. Those animals only possess *voice*, which are provided with lungs. Man, besides the voice which is born with him, has also invented *speech*.

§ 26. The immediate organs of voluntary motion are the *muscles*, which in red-blooded animals form *flesh*, properly so called. In a few animals of very simple structure, as polypes, these organs are indistinguishable from the rest of their gelatinous substance.

§ 27. There are some few muscles over which the will does not possess any power ; such, for instance, is the heart, with its incessant pulsatory motion, (in man about 4500 times an hour) the principal agent in circulation, and not like other muscles, susceptible of fatigue.

§ 28. Both kinds of muscles, however, involuntary as well as voluntary, require the influence of the *nerves* for their power of motion.

§ 29. These nerves arise from the brain and spinal marrow, and it appears that the bulk of the two last, as compared with the nerves springing from them, is inversely proportioned to the intellectual powers of the animal * ; so that man has the largest brain in proportion to his slender nerves ; whilst, on

* This acute remark belongs to M. SÜMMERING.—See his *Dissert. de Basi Encephali*, page 17.

the contrary, animals with limited intellectual powers, such as the amphibia of these countries, possess bulky nerves with a very small brain.

§ 30. Besides the influence which the nerves possess over muscular motion, they have also a second office to perform, in conveying to the mind, through the senses, external impressions made on the animal body. The nature of the organs of sense is, however, very different in different classes of animals. So, for example, many animals evidently receive impressions of every kind by the senses, without our being able to detect the organs which, in others, are essential to the perception of such impressions. Thus, the blue-bottle fly, (*musca vomitoria*) and many other insects have the sense of smell without our being able to perceive that they have a nose; with other similar instances.

Remark. Many have wished to diminish, others, on the contrary, to increase the number of senses. VANINI, for example, and many after him, considered the feeling of sexual enjoyment as a sixth sense; JULIUS CÆSAR SCALIGER, the sensation caused by tickling under the arm-pits as a seventh; an eighth, according to SPALLANZANI, is the feeling by means of which bats, flying in the dark, avoid the contact of objects; and with DARWIN, the feeling of heat and cold formed a ninth.

§ 31. Nerves and muscles, by continued exertion become fatigued, and require for the restoration of their powers occasional repose, which they procure by *sleep*. In man, and most herbivorous animals, night is devoted to this purpose; but many even of these, as the rell-mouse, many animals of prey, to which class belong most fishes, together with many insects and worms, remain concealed during the day, and come forth at night, whence they are called *nocturnal* animals.

§ 32. Besides this daily sleep, a very suitable provision is made in the economy of certain animals, by which they pass a considerable part of the year in a deep sleep, and that precisely at the most rigorous season, when they would otherwise have been unable to provide for their subsistence*. When this time arrives, they creep into secure sheltered places, become torpid as the cold increases, and awake only under the cheering

* “Ergo in hiemes aliis provisum pabulum, aliis *pro cibo somnus*.”—
PLINIUS.

influence of the sun in Spring. This torpidity is so complete, that warm-blooded animals, during their death-like sleep, retain a barely perceptible degree of heat (see Remarks to § 4, above), and that the pupæ of many insects, which undergo metamorphosis at that time, are in Winter so thoroughly frozen as to ring like glass, or icicles, when allowed to drop on the ground, and yet without any injury to the torpid animal within.

As far as is known, no birds, and, on the contrary, most amphibia, have a Winter sleep.

§ 33. Of the intellectual faculties, there are many possessed by man in common with most other animals, such as Perception, Attention, and the two internal senses as they are called, Memory and Imagination.

§ 34. Others are almost wholly confined to animals, so that but slight traces of them are found in man, viz. the natural impulses or instincts: on the other hand, man is in exclusive possession of Reason.

§ 35. Instinct * is the power which animals display of engaging by an internal, innate, and involuntary impulse, spontaneously, and without previous instruction, in the performance of certain offices tending to their own support, and that of the species.

Numerous observations prove that these important offices are performed without reflection, by a principle of necessity, and as it were mechanically; thus, the Hamster breaks the wings even of dead birds before he touches any other part; young birds of passage, which have been brought up alone in confinement, still feel in Autumn the internal impulse to emigrate; and though taken care of and supplied with food, become restless in their cage.

§ 36. Among the many kinds of animal instincts, the *mechanical*, as they are called, are particularly remarkable; by means of them it is, that so many warm-blooded animals and insects are enabled to construct such exceedingly artificial dwelling places, nests, webs, for their own residence, for the security of their young, for the taking of their prey, and many other purposes; all too without instruction, and without practice †, which indeed is, in many cases, impossible; in silk-

* H. S. REIMARUS *Betr. über die Triebe der Thiere*, 4te. Ausg. Hamburg, 1798. 8vo. DUPONT DE NEMOURS.—*Memoires sur differens sujets*, &c. Paris, 1807. 8vo. p. 147-373.

† “Nascitur ars ista, non dicitur.”—SENECA.

worms, &c., for instance, which only employ their power once in their lives, and produce at the same time a first attempt and a master-piece.

§ 37. Excepting the sexual propensity, man exhibits but few traces of instinct. The innate mechanical instinct is in him totally wanting. This apparent deficiency, however, is compensated by the use of reason.

Whether this is to be considered as a faculty exclusively peculiar to the human mind, or as an infinitely more elevated degree of a faculty of which many animals present some faint traces*, or as a particular direction of the collective powers of the human mind; the advantage which man derives from it of improving his condition, is equally undeniable. And since the whole habitable earth is open to him for abode, and almost the whole organized creation for food, the great differences of the climates which he inhabits, and of the food which they afford, create a number of wants which are better supplied by means of *reason*, capable as it is of accommodation in various ways to surrounding circumstances, than they could have been by any uniform instinctive power.

§ 38. How incomparably this single privilege elevates man above the rest of the animal creation, is proved by the unlimited power which it confers upon him of directing the instincts, the habits, the mode of life, in a word, the whole natural disposition of the creatures surrounding him; of taming the most formidable animals, repressing their strongest impulses, and devoting them to the most useful purposes.

Remark. To be convinced how completely man, in a state of cultivation, is master of the other parts of the Creation, it is only necessary to consider the mutual interchanges which he has effected since the discovery of the New World between it and the Old. How many animals and plants have been carried from one to the other; for instance, to the New World, rice, coffee, the horse, ox, &c.; to the Old, the potatoe, tobacco, the turkey, &c.

§ 39. This empire over the rest of the animal creation, for which man is indebted to the gift of reason, is still more conspicuous in the case of his domestic animals. In the strict sense of the term, these consist of such warm-blooded animals as man has deprived of their freedom, and subdued for pur-

* CH. G. LE ROY. *Lettres philosophiques sur l'intelligence et la perfectibilité des animaux.* Paris, 1802. 8vo.

poses of necessity or utility. In a more extended sense, however, bees, the silk-worm, and the cochineal insect, may be considered as domestic animals.

Remark 1st. Domestic animals, properly so called, differ in three ways. Of many, man has subjected the whole species, and reclaimed it from a state of nature, as the horse; of others, the original wild race still exists, as of the ox, swine, cat, rein-deer, the two kinds of camel of the Old World, and our common poultry; lastly, the elephant refuses to propagate in captivity*; and those which are required for the service of man, must be taken and reclaimed from their wild state.

Remark 2d. The domestic animals vary principally in their colour; many of the mammiferous kind are distinguished by their pendant tail and ears, neither of which, however, are constant indications of slavery. (On Domestic Animals—See the *Gotha Almanac*, for 1796.)

§ 40. According to the Linnean system, the whole animal kingdom is ranged under the following six classes:—

I. MAMMALIA.—Animals with warm red blood; viviparous, and suckling their young.

II. AVES.—Animals with warm red blood; oviparous, and feathered.

III. AMPHIBIA.—Animals with cold red blood; breathing by lungs.

IV.—PISCES.—Animals with cold red blood, breathing by gills, and not by lungs.

V. INSECTA.—Animals with cold white blood, having antennæ on the head, and articulated horny organs of motion.

VI.—VERMES.—Animals with cold white blood, without antennæ, for the most part with tentacula, and to the best of my knowledge never with articulated organs of motion†.

* This vulgar error, though very generally received, has been of late years completely refuted by eye-witnesses. See Mr. CORSE in *Phil. Trans.* Vol. LXXXIX. p. 31, &c.—TRANSLATOR.

† This character, taken from the construction of the organs of motion, appears to me more positive than any hitherto proposed for the distinction of Insects and Worms.

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LINNÆI *Fauna Suecica.* Edit. 2d. Holm. 1761. 8vo.

TH. PENNANT'S *British Zoology.* London, 1768-77. 4 Vols. 8vo. Also his Engravings under the same title. Ibid 1763, &c. Gr. folio.

C. P. CR. FLEURIEU *Histoire Naturelle des Oiseaux, des Poissons, des Cetacées, des Amphibies, &c. marins*—in the 2d and 3d Vols. of the *Voyage autour du Monde, par ET. MARCHAND*, Paris, 1800. 4to.

W. E. LEACH'S *Zoological Miscellany.* London, 1814. et seq. 8vo.

SECT. IV.

OF MAMMALIA.

§ 41. Mammiferous animals have warm red blood in common with birds; they are viviparous however, and their leading characteristic, by which they are distinguished from other animals, and from which they derive their appellation, consists in the presence of breasts, with which the females suckle their young. The number and the situation of the breasts is various. For the most part they are as many again as the number of young which the mother brings into the world at one time, and are placed either on the chest, the belly, or between the hind legs*.

§ 42. The body of most, if not all †, mammiferous animals is beset with hairs of very various strength, length, and thickness; which in some is frizzly, as wool; in others stiff and strong, as bristles; and in others, as the hedgehog, &c., forms prickles. In many, the hair in particular situations is elongated, forming a mane or beard; in some, as the horse, dog, &c., it is turned in opposite directions, forming ridges, or sutures, as they are sometimes called. In others again, as the seal, the colour changes with the age. Many also become either grey, as the squirrel (the fur *Petit gris*), or snow white, as the ermine, from the effects of cold (§ 16), with us merely during the depth of Winter, but in the North the whole year through. On the contrary, when this white colour is combined with weak

* Of all the organs of mammiferous animals, the breasts are the only ones which vary so considerably in different species, as well with regard to their situation as their number. In many they have not been detected; as, to the best of my knowledge, in the porcupine. In two fetuses of that animal, however, in my Collection, I find that there are four teats, placed in pairs, in a very unexpected situation, that is, on each side, close behind the shoulder joint. (See *Abbild. N. H. Geg. Tab. 81.*) So also they may yet be found in some unusual situation in the duck-billed animal (*Ornithorhynchus*), in which strangely anomalous creature they have not been discovered.

† For the skin of the whale even has a few hairs here and there, as on the lip, &c.; it also has eye-lashes.

eyes and a red pupil, as in the Albinos of the human race, and of many other species of warm-blooded animals, it is the effect of debility depending upon disease.

§ 43. The abode of mammiferous animals is very different. Most live on the ground; many, as monkeys, squirrels, almost wholly in trees; some, such as the mole, as true subterraneous animals, under ground; others occasionally on land, occasionally in water, as the beaver, the seal; and lastly, some altogether in water, as the whale. The structure of their feet, or corresponding organs of motion, varies accordingly. Most have four feet; man only has two, but also two hands; apes, on the contrary, have four hands. The fingers and toes of those mammiferous animals, which live alternately in water and on land, are connected by membranes. In the bat, the toes of the fore feet are very long and thin, with a fine membrane stretched between them, which enables the animal to fly. The feet of many aquatic animals of this class are adapted to serve as oars, and in the whale they in some degree resemble the fins of fishes, with this difference however, that the posterior ones are without bones, and placed horizontally instead of vertically, as in a fish's tail. Some few mammiferous animals (*solidungula*) have hoofs; many (*bisulca*) cloven feet. The greater number step merely on the toes, particularly of the hinder feet; others, as man, and in some degree apes, the bear, and elephant, on the sole of the foot as far as the heel.

§ 44. Except the ant-eater, manis, and some whales, all other mammiferous animals possess teeth, which are divided into *front teeth* (*primores sive incisores* §), canine (*canini sive laniarii*), and grinding teeth (*molars*). The latter, in particular, are variously formed, according to the various kinds of food on which the animals live. In the carnivorous, the crown is angular, and almost cutting-edged; in the herbivorous, broad above and grooved; and in those which, like man, derive their nourishment from both organized kingdoms, depressed in the middle, and rounded at the edges.

Many mammalia, the elephant and narwhal for example,

* In the greater number, the upper incisors are placed in a particular bone, either single or double, called *os intermaxillare*. I have treated more at length of its remarkable peculiarities in the third edition of my *Treatise De Generis Humani Varietate Nativa*, p. 34, &c., and in the second edition of my *Manual of Comparative Anatomy*, p. 22, &c. A representation of it in the skull of the Orang-Outang is also given in Tab. 52 of my *Abbildungen Natur-Historischer Gegenstände*.

have large prominent tusks (*dentes exserti*); others, as the walrus, projecting canine teeth.

§ 45. It is only among mammiferous animals, and of them among herbivorous ones, that truly *ruminating* species occur; those, viz. which first imperfectly chew and swallow their food, and subsequently return it through the œsophagus in small quantities at a time to the mouth, there to be thoroughly masticated, and then swallowed a second time.

For this purpose, ruminating animals have a peculiar disposition of the teeth; the molar teeth are intersected by serratiform transverse furrows, and the crowns are not placed horizontally, but incline obliquely, so that in the upper jaw the outer side is highest, and in the lower, that next the tongue. Hence they have the lower jaw small, and admitting of considerable lateral motion, by which, as is evident to the sight, the mechanism of this part of the singular function in question is executed.

Remark 1st. In those ruminants which are also cloven-footed (*bisulca*), the fourfold stomach, with its remarkable structure and mechanism, contributes to this object. The food when first swallowed, and in a half crude state, is received, into the immense *first stomach*, as into a store-house, in which it is only a little softened. From it small portions of the food are successively taken up by the *second stomach*, which appears merely an appendage to the first, and propelled a second time through the gullet into the mouth. In the next place, the food after having been again chewed, is carried by a particular groove direct from the gullet into the *third stomach*, without passing through the two first; lastly, it is transmitted to be completely digested in the fourth, which approaches the most closely to the stomach of other mammiferous animals*.

Remark 2d. The general purpose of rumination, as applicable to all the animals which chew the cud, appears to me to be still unknown.

§ 46. Besides claws, teeth, &c., many mammifera are also provided with horns, as instruments of defence. In some species, as the stag, roe, &c., the females are without horns; in others, as the rein-deer, and goat, they have horns, which are smaller than those of the male. The number, shape, and

* See farther my *Manual of Comparative Anatomy*, p. 136, &c.

situation, but particularly the texture of horns, are very different. In the ox, goat, and gazelle, they are hollow, and placed like a sheath over a bony process of the frontal bone. The horns of both kinds of rhinoceros are solid, and merely connected with the integuments of the nose. In the stag genus they are also solid, but of a more bony texture, and branched. They are then called *antlers*, and are commonly cast off and produced afresh every year.

§ 47. In most mammifera the opening of the fundament is covered by the *tail*, which is a continuation of the coccyx, and has various forms and uses. For instance, it serves many animals to drive away the insects which sting them; several *monkeys*, and some other animals of America and New Holland, use it as a hand for support, or for grasping with (*cauda prehensilis*); in the *jerboa*, it is a leaping spring (*cauda saltatoria*); and in the *kangaroo*, an organ of defence, and a balance when sitting in the upright posture.

§ 48. Some animals of this class are also provided with pouches, for various purposes. Thus many apes, baboons, monkeys, and also the hamster, have cheek-pouches for containing their provisions. In the female of the opossum, the teats are placed in a bag on the belly, into which the young ones creep when sucking.

§ 49. Many mammifera, for instance the greater number of bulky herbivorous ones, usually produce but a single young one at once; others, on the contrary, as most beasts of prey, and the hog, have several together.

The young animal is connected to the mother before birth, by what are termed the *secundines*, which are of different forms; thus, in man, they constitute a single bulky mass (*placenta*), in bisulcous ruminating animals are divided into several, and often very numerous distinct connecting organs (*cotyledones*), and so forth.

§ 50. The importance of animals in general may be primarily estimated in a double point of view, viz. either in so far as they influence the economy of Nature in general, and the course of the whole Creation; or, in as much as they are immediately useful to man. In the former respect, insects and worms, as will be hereafter seen, are the most important creatures; in the latter, mammifera, as well from the amount, as from the variety of their utility. The differences in their forms, their great docility, and their strength, render them serviceable to

man in a great variety of ways*. From no other class of animals has he been able to obtain such faithful, serviceable, and industrious assistants; no others are so indispensable to him for his immediate use and support—whole nations are enabled to supply nearly all their most urgent necessities with a single species of mammiferous animals:—the Greenlanders with the seal; the Laplanders, Tunguses, &c. with the rein-deer; the Aleutians, with the whale

§ 51. The varied uses of mammifera to the human species, may be classed in the following way:—For riding, draught, husbandry, carrying burdens—the horse, mule, ass, ox, buffalo, rein-deer, elephant, camel, Llama, dog. For hunting and watching—the dog. For destroying mice and other vermin—the cat, hedgehog, ant eater. For food—the flesh of oxen, the sheep, goat, swine, the deer genus, hare, rabbit, besides lard, tallow, blood, milk, butter, and cheese. For covering, and clothing—furs, leather, hair, wool. For fuel and burning—tallow, train oil, spermaceti †. For writing and bookbinding, &c.—parchment, leather. For other purposes of trade and miscellaneous uses—bristles, hair, antlers, horns, hoofs, ivory, teeth, bone, whalebone, bladders. For glue—guts, tendons and bones. For strings—guts (catgut.) Blood for Prussian blue, and other colours. Bones and hoofs for ivory black, &c. Fat and marrow for soap. Excrement for manure, fuel, sal ammoniac, &c. Lastly, for medicines—musk, castor, hartshorn, milk, and other articles.

§ 52. On the other hand, several animals of this class are directly or indirectly injurious to man. Many carnivora, particularly of the cat genus, attack him. These and many others, as the weasel, martin, polecat, glutton, otter, and whale, destroy serviceable animals; or injure trees, plants, fruit, corn, &c.—as the field mouse, hamster, lemming, deer, hare, beaver, monkey, elephant, rhinoceros, hippopotamus: or consume our provisions, as the rat, mouse, and bat. No animal of this class appears to be venomous when in a state of health, except, perhaps, the male of the duck-billed animal,

* So much so, that in many cases the single individual is of considerable value, as the common and the white whales; not to mention the superior kinds of domestic animals, in which the worth is so much augmented by beauty, fineness of the skin, education, &c.

† Viz. that which is prepared from the macerated flesh of horses and other quadrupeds.—See VOIGT'S *Neues Magazin*, Vol. II. page 772, &c.

(*ornithorhyncus paradoxus*) the spur on the hinder leg of which is considered to be poisonous.

§ 53. Eminent naturalists have suggested various artificial systems for the classification of mammifera; and founded them on particular characters devoted to that purpose. ARISTOTLE'S arrangement, for instance, is founded on the differences of the toes and claws, and has been adopted and extended by RAY and others. But in this way it is necessary to separate the closely connected and very similar species of ant eaters and sloths, and to place them in very different orders, merely because the one has a toe more, the other a toe less. LINNÆUS selected the teeth as his basis of classification; which, however, is not less liable to the objection of producing at one time the most unnatural separations, at another, the most extraordinary approximations*. The bat genus must, in his system, from the differences of the teeth in some species, be divided among at least three orders; so also the two species of rhinoceros; on the contrary, the elephant is placed in the same order with the armadillo and manis.

§ 54. I have therefore attempted to form a more *Natural System* of mammifera: in doing so, I have looked to the general habit of these animals, but particularly to their organs of motion in the formation of the orders, as being most open to inspection, and correspondent to the general habit. Two of these orders, including many animals, I have again subdivided into families according to the differences presented by their teeth, and designated them by the names of some of the Linnean orders: the whole class, therefore, is arranged in the following manner.—

Order I. BIMANUS. Man, with two hands.

II. QUADRUMANA. Animals with four hands.—Apes, Baboons, Monkeys and Makis. (Lemurs.)

III. CHIROPTERA. Mammiferous animals, in which the fore feet form membranes for flying: (§ 43.) Bats.

IV. DIGITATA. Mammiferous animals with separate toes on all four feet. This order is divided according to the differences of the teeth, into the following three families:—

(A.) *Glires*.—With teeth like those of the mouse.

* “Non enim methodicorum scholis se adstringere voluit Natura. Systemata artificialia nostra flocci faciens.”—PALLAS.

squirrel, dormouse, and other mice; the marmot, guinea-pig, jerboa, hare, porcupine.

(B.) *Feræ*.—Carnivorous animals, properly so called, and some other genera with teeth of the same kind. Lions, dogs, &c. The bear, weasel, civets, opossums, hedgehog, shrew, mole.

(C.) *Bruta*.—Without teeth, or at least without fore teeth, &c. Sloths, ant eaters, armadilloes, manis.

V. *SOLIDUNGULA*. The horse, &c.

VI. *BISULCA*. Ruminating animals with cloven feet.

VII. *MULTUNGULA*. Mammiferous animals, for the most part very large, unshapely, with bristles or scattered hairs, with more than two toes on each foot. Swine, (which have usually four toes) the tapir, elephant, rhinoceros, hippopotamus.

VIII. *PALMATA*. Mammiferous animals with feet made for swimming. Subdivided according to the different forms of their teeth, into three families, as above.

(A.) *Glires*.—The beaver.

(B.) *Feræ*.—Seals, otters, &c.

(C.) *Bruta*.—Duck-billed animal, walrus, manati; and from these the most suitable transition to Order

IX. *CETACEA*. Whales, warm-blooded animals, which have nothing in common with cold-blooded fishes but the name, and the natural connexion of which with mammifera was correctly remarked even by RAY*.

For the Natural History of Mammifera.

CONR. GESNERI. *Historiæ Animalium*, L. I. *de Quadrupedibus viviparis*. Basil, 1551. fol.

UL. ALDROVANDI. *De Quadrupedibus digitatis viviparis*.

L. III. Bonon. 1627. fol.

Id. De Quadrupedibus solidipedibus, ib. 1616. fol.

Id. De Quadrupedibus bisulcis, ib. 1613. fol.

Id. De Cetus (at the end of his Work *De Piscibus*.) ib. eod. folio.

Jo. RAII. *Synopsis Animalium Quadrupedum*. Lond. 1693. 8vo.

* “Cetacea quadrupedum modo pulmonibus respirant, coeunt, vivos foetus pariunt, eosdemque lacte alunt, partium denique omnium internarum structura et usu cum iis conveniunt.”—RAIUS.

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Histoire Naturelle des Mammifères, par GEOFFROY ST. HILAIRE et FR. CUVIER, publiée par C. DE LASTEYRIE. Paris. 1819. et seq. Gr. folio.

Tabellarische Uebersicht der Säugthiere nach Illiger, &c. VON J. CHR. L. HELWIG. Helmst. 1819. 8vo.

ORDER I.—BIMANUS.

1. HOMO. Erectus bimanus. Mentum prominulum. Dentes æqualiter approximati; incisores inferiores erecti.

Species 1.—Sapiens. Man *.

Among the external characters by which Man is distinguished, not only from animals in general, but from the Apes which most closely resemble him, are the power of *walking erect* (for which his whole form, but particularly the basin-like shape of his hip-bones, the relative proportion of his thighs and arms, and the wide soles of his feet, are calculated); the facility with which he uses two *perfect hands*; and the prominence of his chin, with the perpendicular direction of the lower incisor teeth.

* See LAWRENCE'S *Lectures on the Natural History of Man*. London, 1819. 8vo. with 12 plates.

The female, beside the peculiar form of the bosom in the bloom of life, possesses two other characters of distinction from the male, and from all other animals, viz. a periodical discharge of blood during a certain number of years; and a particular part in the sexual organs, the absence or destruction of which forms a physical sign of loss of virginity, and which, at least as far as regards its form and position, has not been remarked in any other animal.

As to the mental faculties of man, excepting the sexual propensity, he presents few traces of instinct, and of the mechanical kind none (§ 34, &c.). On the other hand, he is exclusively in possession of reason, (§ 37.) and of speech, which he has invented, and which must not be confounded with the voice, (§ 25.) existing from birth, and even in those born dumb. From these two exclusive privileges is derived the peculiar perfectibility by which he is elevated above the rest of the animal creation. (§ 37.)

Man is, in himself, a defenceless, helpless, creature. No other animal continues so long in a state of infancy; no other is so long before it obtains its teeth; no other is so long before it can stand; no other arrives so late at puberty. Even his greatest advantages, Reason and Speech, are but germs, developed, not spontaneously, but by external assistance, cultivation, and education. This necessity of assistance, and his numerous urgent wants, prove the natural destination of man for *social connexion*. On the contrary, it is not so easy at once to decide, whether the proportion in all parts of the world of the number of males to females born, and the relative proportion of the periods during which both sexes are capable of propagating the species, be such as to render it certain that man is destined elsewhere for monogamy, as well as in Europe.

His residence and his diet are both unrestricted; he inhabits the whole habitable earth, and feeds upon the varied materials derived from the organized creation. Relatively to his moderate bulk, and in comparison with other mammifera, he reaches a very advanced age.

There is but one species of the genus Man; and all people of every time and every climate with which we are acquainted, may have originated from one common stock*. All national

* I have spoken of this subject in my *Treatise de Generis Humani Varietate Nativâ*. 3d Edition.

differences in the form and colour of the human body are not more remarkable nor more inconceivable than those by which varieties of so many other organized bodies, and particularly of domestic animals, arise, as it were, under our eyes. All these differences too, run so insensibly, by so many shades and transitions one into the other, that it is impossible to separate them by any but very arbitrary limits. I conceive, however, that the whole human species may be most conveniently divided into the following five *Races* * :—

1. THE CAUCASIAN RACE.

(*Abbild. Nat. Hist. Gegenst. Tab. 3 and 51.*)

Colour more or less white, with florid cheeks ; hair long, soft, and brown (running on the one hand into white, on the other into black) ; according to the European ideas of beauty, the form of the face and skull most perfect. It includes all the Europeans, with the exception of the Laplanders ; the western Asiatics on this side the Ob, the Caspian Sea, and the Ganges ; lastly, the northern Africans ; altogether the inhabitants of the world known by the ancient Grecians and Romans.

2. THE MONGOLIAN RACE.

(*Abbild. Nat. Hist. Gegenst. Tab. 1.*)

Mostly of a pale yellow (sometimes like a boiled quince, or dried lemon peel) ; with scanty, harsh, black hair ; with half closed, and apparently tumid eyelids ; a flat face, and lateral projections of the cheek bones. This race includes the remaining Asiatics, excepting the Malays ; in Europe, the Laplanders ; and, in North America, the Esquimaux, extending from Behring's Strait to Labrador.

3. THE ETHIOPIAN RACE.

(*Abbild. Nat. Hist. Gegenst. Tab. 5.*)

Black in a greater or less degree ; with black frizzly hair ; jaw projecting forwards ; thick lips and flat nose. Composed of the remaining Africans, viz. the Negroes who pass into the Moors by means of the Foulahs, in the same manner as other varieties merge into one another in consequence of their intercourse with a neighbouring people.

* Compare the Charts of the World, coloured according to this division, in the 1st Vol. of *Archivs für Ethnographie und Linguistik*. Von J. F. BERTUCH und J. S. VATER.

4. THE AMERICAN RACE.

(Abbild. Nat. Hist. Gegenst. Tab. 2.)

Mostly tan colour or cinnamon brown (sometimes like rust of iron or tarnished copper); with straight, coarse, black hair; with a wide, though not a flat face, and strongly marked features. Comprises all the Americans, except the Esquimaux.

5. THE MALAYAN RACE.

(Abbild. Nat. Hist. Gegenst. Tab. 4.)

Of a brown colour, from a clear mahogany to the darkest clove or chesnut brown; with thick, black, bushy hair, a broad nose, and wide mouth. To this class belong the South Sea Islanders, or inhabitants of the fifth part of the world; of the Mariáñne, Philippine, Molucca, and Sunda Isles, &c., with the true Malays*.

The Caucasian must, on every physiological principle, be considered as the primary or intermediate of these five principal Races. The two extremes into which it has deviated, are on the one hand the Mongolian, on the other the Ethiopian. The other two Races form transitions between them; the American between the Caucasian and Mongolian; and the Malayan between the Caucasian and Ethiopian†.

* "Each of these five Races includes two kinds of people, which are more or less strikingly distinguished by their form. Thus, for instance, the Hindoos may be considered as a subdivision or secondary Race, distinct from the Caucasian; the Chinese and Japanese from the Mongolian; the Hottentots from the Ethiopian; the North Americans from those in the Southern part of the New World; and the black Papoos of New Holland, &c. from the brown Otaheitans and other Islanders of the Pacific Ocean."—*Beytr. zur Natur. Geschichte*, 1 Th. p. 72 of the 2d Edition.

† It is allowable to suppose that the people dispersed through the various parts of the world have, according to the differences in the degree and duration of the influence of climate and other causes of degeneration, either deviated still more from the form of the primary race, or approximated more closely to it. Thus, for example, the Jakuts, Koraks, Esquimaux, and other polar nations of the Mongolian Race, have deviated considerably from the Caucasian Race; whilst on the other hand, the American, placed at a greater distance, but in a milder climate, has in an equal degree approximated; and it is only at the Southern extremity of the Continent, in the frozen Tierra del Fuego, that it again recedes to the Mongolian. So also the Ethiopian Race has passed to the extreme of variation in the burning regions of Africa, but passes into the Malayan in the milder climate of New Holland, the New Hebrides, &c. It is unnecessary to point out the influence of the mixture of different Races, which accidentally come in contact with each other in their emigrations.

It is unnecessary to recount all the fabulous imaginations with which the Natural History of the human species has been burdened; to notice a few however:—The supposed Patagonian giants have sunk in the relations of travellers, from Magellan's times down to our own, from twelve feet to seven and a half, and at last are but little taller than any other men of good stature.

It is also rendered more than probable by pathological considerations, that the *Quimos* of Madagascar, set forth by COMMERSON as a nation of pygmies, are nothing else than a kind of cretins, or idiots, with big heads and long arms, such as are met with in the district of Salzburgh, in the Pays du Vaud, and in Piedmont.

So also the Albinoes, Kackerlacken, or white Ethiopians*, are not even a variety, much less a species; but rather specimens of disease, coming more within the range of Pathology than of Natural History.

The *homo troglodytes* of LINNÆUS, is an incomprehensible combination of the history of the Albino resulting from disease, and of the Ourang-outang: his *homo lar*, on the contrary, is a true Ape.

The children † who have lived in a savage state among brutes are wretched monsters in intellect, which can no more be considered as perfect specimens of the master-piece of the Creation, than other men disfigured by accident or disease.

The fables of men with tails, of the natural apron of the Hottentot women, of the supposed natural deficiency of beard in the Americans ‡, Syrens, Centaurs, and others of the same stamp, can only be excused by the simple easy credulity of our ancestors.

II. QUADRUMANA.

Mammifera with four hands, which are required by their

* These white Ethiopians, or Negroes as they are called, must be distinguished from the *Negroes spotted white*. One of these whom I saw in London, and a specimen of whose black and white woolly hair I possess, is represented in my *Abbild. Nat. Hist. Gegenst.* Tab. 21. from the life.

† I have treated of this matter more fully in my *Beytr. zur Natur. Geschichte*, 2 Th. p. 13, 14.

‡ I have admitted a difference in the strength of the growth of hair in the Mongolian and Malayan Races; but the want of beard in many American nations is artificial, as much as the small feet of the Chinese women, (the *Struthopodes* of the *Eudoxus* of PLINY.).

mode of life and residence in trees. They are originally natives only of the countries between the Tropics.—(*Histoire Naturelle des Singes, peints d'après Nature*, par J. D. AUDEBERT. Paris, 1797. Gr. fol.)

2. SIMIA.—Ape. Ger. Affe. Fr. Singe. Habitus plus minus anthropomorphus, auriculæ et manus fere humanæ, nares anteriores. Dentes *primores* incisores, supra et infra 4; *laniarii* solitarii, reliquis longiores.

Confined to the Old World; more nearly approaching to man than the animals of the succeeding genera, but easily distinguished from him, not only by the characters already pointed out, but also by the entire form, and particularly by the flatness of the loins and smallness of the hips.

(a.) WITHOUT TAILS.

1. *Satyrus*. The Ourang-outang.—*S. rufa*, pilis longis raris, capite globoso, fronte tumida, auriculis minoribus.

(*Abbild. Nat. Hist. Gegenst.* Tab. 12. and 22.)

Confined apparently to the island of Borneo, and even there in small number*; when taken young it can, as well as the chimpansé and other apes, be taught to perform a variety of actions, which however must not be confounded with its natural habits.

As CAMPER has proved by dissection, it is not capable either of speech or of walking naturally in an upright posture.

2. *Troglodytes*. The Chimpansé.—*S. nigra*, macrocephala, torosa, auriculus magnis.

(*Abbild. Nat. Hist. Gegenst.* Tab. 11.)

In the interior of Angola, Congo, &c., like the preceding species, about the size of a child of three years.

3. *Lar*. The Gibbon. (*Homo Lar* of LINNÆUS.)—*S. brachiis longissimis*, talos attingentibus.

(SCHREBER. Tab. 3.)

In both the Indian Peninsulas, and in the Moluccas: has a round face tolerably like that of man, with very long arms, and is of a black colour.

4. *Sylvanus*. The Barbary Ape.—*S. brachiis corpore brevioribus*, natibus calvis, capite subrotundo.

(SCHREBER. Tab. 4.)

In North Africa, the East Indies, &c., the strongest and the

* Consequently a very small species; whilst the human, on the contrary, amounting to about a thousand millions, is certainly the largest among mammiferous animals.

most common of all the tail-less apes; it also readily breeds in Europe, and is very docile. Scarcely different from the *Inuus*, (BUFFON's *Magot*). It has become wild at Gibraltar, and breeds there in a state of freedom.

(b.) WITH TAILS.

5. *Rostrata*. The long-nosed Ape. *Ger.* der langnasige. *Affe.* *Fr.* la Guenon à long nez.—*S.* cauda mediocri, naso elongato, rostrato.

(*Abbild. Nat. Hist. Gegenst.* Tab. 13.)

From the Sunda Isles. It is *simia*, but not *sima*; being remarkable for its long proboscis-like nose.

6. *Silenus*. The Wanderow, *Ger.* der Bartaffe.—*S.* caudata, barbata, nigra, barba incana proluxa.

(SCHREBER. Tab. 11.)

From Ceylon, &c.: old and scarcely recognizable representations * of this ape have been transformed by the embellishments of subsequent copyists † into the supposed men with tails.

7. *Cynomolgus*. The Macaco. *Ger.* die (insgemein so genante,) Meerkatze. *Fr.* le Macaque.—*S.* cauda longa, arcuata, naribus bifidis elatis.

(SCHREBER. Tab. 12.)

From Guinea, Angola, &c.: nearly olive green. Of true Apes with tails, that which is most frequently brought to Europe.

3. *PAPIO*.—Baboon. *Ger.* Pavian. *Fr.* Babouin.—*Facies* prolongata, minus anthropomorpha, *nasus* utrinque tuberosus, *nates* nudæ, *coccineæ*, *cauda* (*plerisque*) ‡ abbreviata. *Dentes* ut in *simiis*.

Also confined to the Old World. The head has little resemblance to that of man; on the contrary, in many is more like that of the hog, particularly in the snout. In general, they are very untameable and lascivious.

1. *Hamadryas*. (*Cynocephalus*.) *Ger.* der Hundskopf. *Fr.* le Tartarin.—*P.* cinereus, *auriculis* comosis, *unguibus* acutiusculis.

(SCHREBER. Tab. 10.)

In Egypt and Africa to the Cape of Good Hope. It is often

* Originally in BERNH. VON BREYDENBACH *Reyss in das gelobt Land*. Mainz, 1486. folio.

† For instance, in Vol. VI. of MARTINI's *Translation* of BUFFON.

‡ For the formidable baboon of Borneo (*papio pongo*) is tail-less, whilst the *cynocephalus* may be said to be long-tailed.

represented in the hieroglyphics of the ancient Egyptians*.

2. *Mormon*. The ribbed faced Baboon. *Ger.* der Choras.—

P. naso miniato ad latera cærulescente.

(SCHREBER. Tab. 8 A. 8 B.)

From Ceylon, &c.: is near five feet high; has a singular appearance, from the bright coloured streaks upon and at the sides of the nose.

3. *Maimon*. The Mandrill.—*P. facie violacea, glabra, profunde sulcata.*

(SCHREBER. Tab. 7.)

From Guinea, the Cape, &c., where whole droves of them often plunder the vineyards and orchards; much smaller than the preceding species.

4. *CERCOPITHECUS*.—Monkey. *Ger.* Meerkatze.—*Auriculæ et manus minus humanæ. Nares laterales. Nates tectæ. Dentes ut in simiis.*

The whole genus is confined to the warmer parts of South America, where the Indians commonly use it as game.

(a.) *Cauda prehensili*.—Sapajous.

1. *Seniculus*. *Ger.* der rothe Brüllaffe. *Fr.* l'Alouate.—*C. barbatus rufus, gutture tumido.*

(*Abbild. Nat. Hist. Gegenst.* Tab. 91.)

In troops in the great forests of Guiana, &c., where it, together with another species, (*Cercop. Belzebub*.) emits a deafening noise, principally on change of weather, and which is produced by a remarkable bony cavity in the larynx, placed between the unusually large lateral portions of the lower jaw.

2. *Paniscus*. The Coaita.—*C. ater, palmis tetradactylis, absque pollice.*

(SCHREBER. Tab. 26 A. 26 B.)

Extremely dexterous in the use of its long prehensile tail†.

(b.) *Cauda non prehensili*.—Sagouins.

3. *Jacchus*. The Ouistiti. *Ger.* Uistiti.—*C. juba pilosa alba ad genas ante aures, cauda villosa annulata.*

(SCHREBER. Tab. 33.)

Brown, and so small that it will fit in the shell of a cocoa nut.

* See the *Rouleau de Papyrus* publiée par CADET, 1805.

† The singular manner in which they hang together, so as to form a chain, for the purpose of swinging themselves from one tree to another on the opposite banks of a river, is represented in the original edition of ANT. de ULLOA's *Viage*, &c. Madrid, 1748. fol. Vol. I. p. 144-149.

5. LEMUR.—Makis. *Nasus acutus*, dentes *primores superiores* 4 ; *per paria remoti* ; *inferiores* 4—6, *porrecti*, *compressi*, *incumbentes* : *laniarii solitarii*, *approximati* *.

1. *Tardigradus*. The Lori.—*L. ecaudatus*.

(SCHREBER. Tab. 38.)

From Ceylon ; of the size and colour of a squirrel ; with slender legs, and together with the next species, has a pointed claw on the index toe of the hinder foot, but on all the other toes a flat nail.

2. *Mongoz*. The Mongoz.—*L. facie nigra*, *corpore et cauda griseis*.

(SCHREBER. Tab. 39 A. 39 B.)

Together with some similar species in Madagascar and the neighbouring isles. The hinder are much longer than the fore feet. Its skin, like that of many apes, has a peculiar smell, nearly resembling that of an ant hill.

III, CHIROPTERA.

The fingers of the fore feet, the thumb excepted, are, in these animals, longer than the whole body, and between them is stretched a thin membrane for flying (§ 43.). Hence they are as little capable of walking on the ground as apes with their hands, or sloths with their hooked claws, which are calculated for climbing.

6. VESPERTILIO.—Bat. *Ger.* Fledermaus. *Fr.* Chauve-souris.—*Pollex palmarum et digiti plantarum breves*, *reliqui longissimi*, *membranæ expansili intertexti*, *pro volatu*.

A very extensive genus of nocturnal animals, the different species of which are dispersed through all the five parts of the world.

(A.) *Dentibus primoribus* 4, *utrinque*.

1. *Spectrum*. The Vampire.—*V. ecaudatus*, *naso infundibuliformi lanceolato*.

(*Abbild. Nat. Hist. Gegenst.* Tab. 31.)

In South America. The body about the size of a squirrel. It proves very troublesome by sucking the blood, not only of the larger mammifera, but also of men when asleep, in whom it

* GOTTH. FISCHER'S *Anatomie der Makie*. 1 B. Frankf. 1804. 4to. with plates.

commonly attacks the toes ; on this account it has received its name.

2. *Caninus*. Roussette. Eng. and Fr.—Der fliegende Hund.
Ger. Vampyrus of LINNÆUS.—*V. ecaudata*, naso simplici,
 membrana inter femora divisa.

(SCHREBER. Tab. 44.)

Much larger than the Vampyre, so that its flying membranes, when extended, measure six feet ; it lives, however, solely on fruits, and has therefore no claim to the appellation, Vampyre. Occurs in troops in Hindostan, and in the Indian and Australasian islands, and in vast numbers in New Holland. It is the only mammiferous animal on the Pellew islands.

(B.)—*Dentibus primoribus supra 4, infra 6.*

3. *Auritus*. The long-eared Bat. L'Oreillard of BUFFON.—
V. caudatus, auriculis maximis.

Together with the following species in the milder regions of the Old World. Their ears, which are commonly, but incorrectly, said to be double, are single ; but in all their parts extremely large.

4. *Murinus*. The Bat, Rear Mouse. *Ger.* die gemeine Fledermaus. *Fr.* la Chauve-souris commune.—*V. caudatus*,
 auriculis capite minoribus.

This, as well as the preceding species, suspends itself by its hinder feet in caverns during its hybernation. In many situations it multiplies to a great extent in a very short period.

(C.) *Dentibus primoribus superioribus nullis.*

5. *Ferrum equinum*. The Horse-shoe Bat. *Ger.* Die Hu-feisennase.—*V. naso foliato ferri equini æmulo.*

(*Abbild. Nat. Hist. Gegenst.* Tab. 42.)

In the Middle and Southern parts of Europe.

IV. DIGITATA.

Mammifera with separate toes on all four feet. This order contains the greatest number of genera and species, and is therefore conveniently divided, according to the differences of the teeth, into three families.

(A.) *Glires*. (B.) *Feræ*. (C.) *Bruta*.

(A.) *Glires*. (*Scalpris dentata*. JO. HUNTER.)

With two chisel-shaped incisor teeth in each jaw, for the purpose of gnawing ; without canine teeth.

7. *SCIURUS*.—*Cauda pilosa, disticha. Dentes primores utrinque 2 ; inferiores subulati.*

1. *Volans*. The Flying Squirrel. *Ger.* das fliegende Eichhörnchen. *Fr.* le Polatouche.—*S. duplicatura cutis laterali a pedibus anterioribus ad posteriores.*

(*Abbild. Nat. Hist. Gegenst. Tab. 71.*)

In Livonia, Russia and Siberia. Of the colour of the fur called *Petit-Gris*. The loose membrane extended laterally between the fore and hind feet serves the purpose of a parachute, and enables the animal to spring from great heights.

2. *Vulgaris*. The Squirrel. *Ger.* das Eichhörnchen. *Fr.* l'Ecu-reuil.—*S. auriculis apice barbatis, cauda dorso concolori.*

(*v. WILDUNGEN Taschenbuch, für 1808.*)

In the whole of Europe, and most parts of Asia. Those of the North, particularly on the banks of the Ob and the Baikal Lake, become grey in Winter, and furnish the true *Petit-Gris*. (*Grauwerk.*) Sometimes there are black squirrels; less frequently snow white with red eyes, and more rarely still, spotted with black and white.

The Virginian species, *Sc. cinereus* (*BUFFON's Petit-gris,*) is larger, and without tufts in the ears. It does great damage to the plantations of Maize.

8. *GLIS*. (*Myoxus*.) *Cauda rotunda, versus apicem crassior. Dentes ut in sciuris.*

1. *Esculentus*. The Rell Mouse, the fat Dormouse. *Ger.* die Rellmaus, der Siebenschläfer, Katz, Bilch. *Fr.* le Loire.—*G. griseus, subtus albidus, auriculis rotundatis, nudis.*

(*SCHREBER. Tab. 225.*)

Together with the next species in the milder regions of the Old World. The true *glis* of the ancients, which they used as food *, and fattened in *glirariis* † for the purpose. It lives in oak and beech forests, builds its nest in hollow trees, and has a very long and profound Winter sleep.

2. *Avellanarius*. The Dormouse. *Ger.* die Kleine Haselmaus. *Fr.* le Muscardin.—*G. rufus, pollice plantarum mutico, auriculis rotundatis.*

(*SCHREBER. Tab. 227.*)

Smaller in the body than the domestic mouse. For its Winter sleep it prepares a globular and tolerably solid nest of the needle shaped leaves of the fir, &c., in which it conceals itself.

9. *Mus*. *Cauda gracilis, subnuda. Dentes ut in præcedentibus.*

* *APICIUS, VIII. 9.*

† *VARRO de R. R. III. 15.*

1. *Æconomus*. The Economic Rat. *Ger.* die Wurzelmaus.—*M. cauda subsesquiuunciali, auriculis nudis vellere molli latentibus, palmis subtetradactylis, corpore fusco.*

(SCHREBER. Tab. 190.)

In all Siberia, and as far as Kamschatka. Remarkable for the emigrations which it makes principally from Kamschatka, like the Lemming in certain years; but still more so, for the industry with which it collects large quantities of roots in its burrows, which are plundered by the Tungooses, &c., in the same manner as the stores of the Hamster by the inhabitants of Thuringia.

2. *Sylvaticus*. The Field-rat. *Ger.* die Waldmaus. *Fr.* le Mulot.—*M. cauda mediocri, pectore flavescente, abdomine albido.*

(SCHREBER. Tab. 180.)

Does much injury to corn and newly planted trees.

3. *Amphibius*. The Water-rat. *Ger.* die Wasserratte, der Erdwolf. *Fr.* le Rat d'eau.—*M. cauda longitudine dimidia corporis, auribus vix vellere prominulis, palmis subtetradactylis.*

(SCHREBER. Tab. 186.)

In all the northern parts of the world. Very injurious to gardens, and particularly to the roots of plants*.

4. *Arvalis*. The Field-mouse. *Ger.* die Feldmaus, Stossmaus. *Fr.* le Campagnol.—*M. cauda mediocri, dorso ferrugineo, abdomine cinereo.*

(SCHREBER. Tab. 191.)

Multiplies in certain years to a vast extent, and does great injury to the Winter corn. In this, as in the following species, Albinos are occasionally met with.

5. *Musculus*. The Mouse, *Ger.* die Hausmaus. *Fr.* la Souris.—*M. cauda elongata, palmis tetradactylis, pollice palmarum mutico.*

In Europe, and the temperate climates of Asia and America. It has attached itself to man in some degree as a domestic animal.

The white Mice with red eyes (Albinos) are occasionally so sensible to the impression of light, as to close their eye-lids in full day, so as to have the appearance of being blind.

* I lately received from this neighbourhood a beautiful variety of this species, ermine white, with a few brownish grey spots on the back.

6. *Rattus*. The black Rat. *Ger.* die Ratte. *Fr.* le Rat.—*M. cauda elongata, palmis tetradactylis cum unguiculo pollicari.*

Dispersed over all the five parts of the world, but apparently originally a native of the middle regions of Europe. Extremely voracious. It eats even scorpions, and follows man and his provisions every where, into the deepest mines as well as into his ships. Among others, one of the greatest enemies to the sugar plantations of the West Indies.

In many places it has been gradually supplanted by the Norway Rat, (*Mus decumanus*.) which is originally a native of Persia and the East Indies, and is of a reddish grey colour, with a few bristly hairs scattered through its fur.

10. *MARMOTA*. (*Arctomys*.) *Auriculæ abbreviatæ, cauda brevis, aut nulla. Dentes ut in præcedentibus.*

1. *Alpina*. The Marmot. *Ger.* das Murmelthier. *Fr.* la Marmotte. In the Grisons, *Murmont*—from the Latin, *Mus-montanus*.—*M. corpore depresso, supra fusco, subtus flavescente.*

(*V. WILDUNGEN Taschenbuch, f. 1812.*)

In many of the highest Alpine regions of Europe and Asia. It is remarkable that it is occasionally met with on the *Allée Blanche*, in Savoy, upon isolated rocks, which project like islands from the sea of ice, at the distance of some leagues from any part that is not frozen, and not free from snow for more than six weeks in the whole year; so that it would appear that the Marmot, in such situations, must sleep at least ten months in the year, and pass an extremely small part of its existence in a waking state.

2. *Citellus*. (*Mus ponticus*.) Earless Marmot. *Ger.* das Erdzeiselchen.—*M. Auriculis minimis, cauda villosa, corpore vario.*

(*SCHREBER. Tab. 211.*)

Principally found in Hungary, Poland, and Siberia. About the size of the Hamster, and like it has cheek-pouches.

3. *Cricetus*. The Hamster.—*M. abdomine nigro.*

(*F. G. SULZERS' N. G. des Hamsters. Gött. 1774. 8vo. Tab. 1, 2.*)

In many parts of Germany, Poland, Siberia, &c. Lives chiefly on corn and beans, of which it carries large quantities in its cheek-pouches to its subterraneous burrows, sometimes seven feet deep. A hole of this kind will contain sixty pounds of such provisions. It increases rapidly, and in the district of Gotha alone, as many as 90,000 Hamsters have been killed in one

Summer. There is a black variety of this animal, as well as an Albino with red pupils.

4. *Lemmus*. The Lemming.—*M. capite acuto, corpore nigro fulvoque irregulariter maculato.*

(SCHREBER. Tab. 195 A. 195 B.)

Common in Lapland and Siberia. Sometimes whole legions emigrate from one place to another. Their unexpected and unnoticed arrival, together with the accidental fall of those which may have escaped from the claws of birds of prey, by which they had been taken up into the air, probably gave rise to the ancient saying that the Lemmings fell from the heavens.

5. *Typhlus*. The Blind Rat. *Ger. die Blindmaus. Fr. le Zemni.*
—*M. ecaudata, palmis pentadactylis, incisoribus supra infraque latis, palpebrarum aperturis auriculisque nullis.*

(SCHREBER. Tab. 206.)

In the south of Russia. Lives chiefly under ground. It has a small distinct pupil, but no opening in the eye-lids, and consequently is blind.

11. *HYRAX*. (Daman.) *Dentes primores superiores 2, distantes, inferiores 4, contigui, palmæ digitis 4, plantæ digitis 3, cauda nulla.*

1. *Capensis*. The Daman. Cape Hyrax. *Ger. der Klipdas. Fr. la Marmotte du Cap.*—*H. palmarum unguibus planis, plantarum unico subulato.*

(SCHREBER. Tab. 240.)

At the Cape, &c. About the size of the Marmot: burrows like it also in the ground, but is difficult to classify on account of its peculiar anomalous structure, particularly of the teeth and feet.

12. *SAVIA*. *Auriculæ rotundatæ, parvæ. Cauda nulla aut brevis. Dentes primores utrinque 2.*

The whole Genus confined to the warmer parts of South America, particularly Brazil.

1. *Porcellus*. The Guinea Pig. *Ger. das Meersweinchen. Fr. le Cochon d'Inde.*—*S. ecaudata, corpore variegato.*

(SCHREBER. Tab. 173.)

Thrives well in Europe, varies in colour, and is certainly the most prolific of all mammifera. It is at present seldom found in the wild state.

2. *Aguti*. The Agouti. Eng. and Fr.—*Ger. das Ferkelkaninchen.*—*S. caudata, corpore ex rufo fusco, abdomine flavescente.*

(SCHREBER. Tab. 172.)

Larger than a Rabbit.

13. *LEPUS*. Dentes *primores* utrinque 2; superiores duplicati.

1. *Timidus*. The Hare. *Ger.* der Hase. *Fr.* le Lièvre.—*L.* auriculis apice nigris, corpore et pedibus posticis longioribus.

(v. WILDUNGEN *Taschenbuch* f. 1798.)

In almost the whole of the Old World, as well as in North America, the soles of the feet and in part the mouth, are covered with hair. Both the Hare and the Rabbit appear to ruminant*.

Many able naturalists have admitted the truth of the reports of individual hares being met with at different times and places, possessing small, but perfect horns †.

The Varying Hare. (*Lepus variabilis*) (Berghase, *Ger.*) in many Northern and Alpine situations, is distinguished from the common one by its broader head, shorter ears, shorter tail, and longer hind legs, with extremely broad feet; neither do they breed together. In the extreme North, as Greenland, &c. it is white all the year through; in the Swiss and Tyrolean Alps, only during Winter ‡.

2. *Cuniculus*. The Rabbit. *Ger.* das Kaninchen. *Fr.* le Lapin.—*L.* Auriculis nudatis, corpore et pedibus posticis brevioribus.

(v. WILDUNGEN *Taschenbuch*, f. 1799).

Originally a native of the warmer regions of the Old World, but now also found in its northern parts. They increase so rapidly, that on some occasions they have become a public calamity ||, as in the year 1736, on the island of St. Peter, near Sardinia §; they propagate in the most desert places, as on Volcano, one of the Lipari Islands, otherwise uninhabited. The wild animal is grey; the white, with red eyes, are among the most common kinds of Albinos.

* Leviticus, Chap. ii. v. 5, &c.

† I have given my reasons for doubting the truth of such reports in my *Manual of Comparative Anatomy*, p. 34.

‡ See MEISNER'S *Museum der Natur. Gesch. Helveticus*, No. 4.

|| "Certum est, Balearicos adversus proventum cunicolorum auxilium militare a divo Augusto petisse."—PLINIUS.

§ CETTI. *Quadrupedi di Sardegna*, p. 149.

The long-haired Angora Rabbit, (Englische Seidenhase), (§ 16. Remark 2d.) also thrives in this part of the world.

14. *JACULUS*. (Dipus.) *Pedes antici brevissimi, postici elongati. Cauda saltatoria, apice floccosa. Dentes primores utrinque 2.*

1. *Jerboa*. The common Jerboa. *Ger.* der Springhase. *Fr.* la Gerboise.—*J. palmis tridactylis; plantis tetradactylis.*

(*SCHREBER. Tab. 228.*)

Principally in North Africa, Arabia, &c. Burrows in the ground. Leaps, with the agility of a grasshopper, the distance of seven or eight feet at a time.

15. *HYSTRIX*. Porcupine. *Ger.* Stachelschwein. *Fr.* Porcs-Epic.—*Corpus spinis tectum. Dentes primores utrinque 2.*

1. *Cristata*. The crested Porcupine.—*H. spinis longissimis, capite cristato, cauda abbreviata.*

(*Abbild. Nat. Hist. Gegenst. Tab. 81.*)

Originally in the warmer parts of Asia, and almost the whole of Africa; feeds principally on the bark of trees; burrows in the ground. When angry, it rattles its prickles, which occasionally fall off, particularly in Autumn; it has not, however, any power of shooting them at its pursuers*.

2. *Dorsata*. (Urson.) Canadian Porcupine. *Fr.* l'Urson.—*H. spinis brevibus sub pilis occultis.*

(*SCHREBER. Tab. 169.*)

From Canada, Labrador, and the country about Hudson's Bay. It does great mischief to the trunks of young trees, particularly in Winter.

(B.) FERÆ.

With pointed or angular front teeth, and mostly with only a single canine tooth on each side, which is generally, however, of remarkable size and strength. The carnivorous animals, properly so called, and some other genera with teeth of the same kind, compose this family.

16. *ERINACEUS*. *Corpus spinis tectum. Dentes primores utrinque 6†; lanarii supra 3, infra 1, molares 4.*

* The high-priced biliary concretion, (*pedra del porco*) formerly famed as a panacea, is found in an East Indian Species of Porcupine, that is not yet accurately known.

† Not 2, as LINNÆUS supposed; for the upper incisors are all those which are fixed in the intermaxillary bone (Note to § 44.); and the lower, all those in the front of the jaw, which correspond to the upper.

1. *Europæus*. The Hedgehog. *Ger.* der Igel. *Fr.* le Herisson.—*E. auriculis rotundatis, naribus cristatis.*

In almost the whole of the Old World: a nocturnal animal: feeds both on animals and vegetables: mouses like a cat; can eat cantharides in great quantity. It sticks its prickles into fruit, for the purpose of bringing them to its holes, a thing which had been asserted by the ancients, and denied by the moderns, but of the fact I have been assured by three credible witnesses*.

17. *Sorex*. *Nasus rostratus, auriculæ breves. Dentes primores superiores 6†, bifidi; inferiores 2—4, intermediis brevioribus; laniarii utrinque plures.*

1. *Arancus*. The Shrew. *Ger.* die Spitzmaus. *Fr.* la Musaraigne.—*S. cauda mediocri, abdomine albedo.*

(SCHREBER. Tab. 160.)

In Europe, the North of Asia, &c. There is no truth in the common assertion that it is venomous, or that it creeps into the body of horses. White shrews are uncommon.

2. *Fodiens*. The Water-Shrew. *Ger.* die Wasserspitzmaus. *Fr.* la Musaraigne d'eau.—*S. abdomine cinereo, digitis ciliatis.*

(*Abbild. Nat. Hist. Gegenst.* Tab. 72.)

In Europe on the banks of ponds. Instead of a swimming membrane the toes are furnished with small stiff hairs, which render the foot excellently adapted for rowing. The opening of the auditory passage has a valve, which the animal can close as long as it is under water.

3. *Exilis*. The minute Shrew.—*S. minimus, cauda crassissima tereti.*

On the Jennisey and Ob. The smallest mammiferous animal yet known: it weighs but half a drachm.

18. *TALPA*. *Caput rostratum, palmæ fossoriæ. Dentes primores superiores 6, inferiores 8, laniarii major 1, minores 4.*

1. *Europæa*. The Mole. *Ger.* der Maulwurf. *Fr.* la Taupe.—*T. cauda brevior, auriculis nullis.*

In almost the whole of the Old World. A completely subterranean animal, for which it is fitted by the peculiarities of its structure, particularly of its shovel-shaped paws. It has very

* Dr. PATRICK RUSSEL makes a similar statement in the new Edition of his brother's *Nat. Hist. of Aleppo*, Vol. I. p. 419.

† This is the case at least in the Water Shrew.

small eyes, can swim well, and in times of floods climb up trees. A variety of a dull yellow is occasionally met with.

2. *Versicolor*. (Aurata.) *T. ecaudata, palmis tridactylis*.

(VOSMAER's *Monograph*, 1787.)

Only at the Cape; consequently cannot be called (as by LINNÆUS) Asiatic. The hair, particularly when damp, glitters with a gold-like splendour.

19. *DIDELPHIS*. *Hallux (plerisque) muticus*. *Fœminis folliculus abdominalis mammarum*.

This Genus, composed of numerous and closely connected Species, presents such varieties in the teeth, that according to the Linnean system it would be necessary to divide it into several Genera.

1. *Marsupialis*. The Opossum. *Ger. das Beutelthier. Fr. le Sarigne*.—*D. albida, auriculis, antibrachiis et tibiis nigris, cauda squamosa longitudine corporis. Dentes primores superiores 10, inferiores 8, laniarii elongati*.

Chiefly in the warmer parts of North America*. The female of this, and other species of the Genus, has a large pouch on the belly, which can be opened and closed by particular muscles, and at the bottom of which the teats are placed. The young ones are born small beyond all proportion, like imperfect abortions. They are carried in this pouch for a length of time, continuing to suck, and being nourished by the mother's milk, until having become mature, and more perfectly formed, they are as it were born for the second time.

2. *Gigantea*. The Kangaroo. *Ger. das Känguruh*.—*D. grisea, cauda longa crassa, pedibus anticis brevissimis, posticis longissimis. Palmis pentadactylis, plantis subtetradactylis. Dentes primores superiores 6, inferiores 2, laniarii nulli*.

(SCHREBER. *Tab.* 154.)

In New Holland. Mouse grey. When sitting upright is as high as a man, and weighs 140 lbs. Lives together in herds of fifty or more. Is altogether herbivorous. Moves by leaps of full 12 feet at a time. The female has an abdominal pouch; produces but a single young one at a time, which, when born, is scarce half so large as a mouse, but is carried in the mother's pouch three quarters of a year, until it weighs nearly 14 lbs.

3. *Wombat*. The Wombat. (*Phascolomys*).—*D. subfusca*,

* I have communicated some observations which I made on a living Opossum in VOIGT's *Neues Magazin*, Vol. III. p. 683, &c.

cauda brevissima. Dentes *primores* utrinque 2, cylindrici, obtusi; *laniarii* nulli; *molares* 5.

(LEACH. Vol. II. Tab. 96.)

Also from New Holland. Of the size of the Badger. Apparently a nocturnal animal, which burrows in the earth.

20. *VIVERRA*. Caput vulpinum. Cauda plerisque felina.

Dentes *primores* utrinque 6, intermediis brevioribus. Lingua plerisque retrorsum aculeata. Ungues exserti.

1. *Zibetha*. (*Hyæna odorifera*.) The Civet. *Ger.* die Zibethkatze. *Fr.* la Civette.—V. cauda annulata, dorso cinereo nigroque undatim striato.

(SCHREBER. Tab. 112.)

In the south of Asia and north of Africa. In both sexes of the Civet, a fatty odoriferous substance is contained in a particular cavity, placed between the anus and organs of generation.

2. *Genetta*. The Genet Cat. *Ger.* die Genettkatze. *Fr.* la Genette.—V. cauda annulata, corpore fulvo-nigricante maculato.

(SCHREBER. Tab. 113.)

In the Levant. Is prized on account of its skin.

3. *Putorius*. The Skunk. *Ger.* das Stinkthier. *Fr.* la Mouffette.—V. lineis quinque dorsalibus parallelis albis.

(SCHREBER. Tab. 122.)

In Virginia, Canada, &c. It has its name from the insupportable stink, which it, like several other species of this genus, emits when enraged.

4. *Ichneumon*. The Egyptian Ichneumon. *Ger.* die Pharaonsmaus. BUFFON'S *Mangouste*.—V. cauda basi incrassata sensim attenuate apice floccosa.

(SCHREBER. Tab. 45 B.)

Has coarse, almost bristly hair, with broad, brown ring-like stripes. Is common in Egypt, where it destroys the eggs of the crocodile, and also serpents: it is, however, easily tameable.

5. *Aurita*. Fennec. *Ger.* das Grossohr. BUFFON'S *Animal Anonyme*.—V. auriculis amplessimus.

(BRUCE'S *Travels to the Source of the Nile*. Vol. V. Tab. 22.)

In Barbary, Nubia, &c. It nests in palms, and lives chiefly on dates.

21. *MUSTELA*. Dentes *primores* superiores 6, erecti, acutiores, distincti; inferiores 6, obtusiores, conferti; duo interiores. Lingua lævis.

The species of this genus have short legs and a long slender

body, which is arched in walking. They are very active, malicious, and blood-thirsty.

1. *Martes*. The Pine Martin. *Ger.* der Baummarder, Edelmarder, Feldmarder. *Fr.* la Marte.—*M. corpore fulvo nigricante, gula flava.*

(v. WILDUNGEN *Taschenbuch*, f. 1800.)

Principally in the pine forests of the northern part of the world. Its beautiful fur comes nearest to that of the sable.

2. *Foina*. The Martin. *Ger.* der Hausmarder, Steinmarder. *Fr.* le Fouine.—*M. corpore fulvo nigricante, gula alba.*

(v. WILDUNGEN. l. c.)

In the middle and warmer parts of Europe, with the neighbouring regions of Asia. When taken young, it may, as well as the preceding species, be made wonderfully tame.

3. *Putorius*. The Polecat, Fitchet. *Ger.* der Iltis, Ilk, Stänkerrat. *Fr.* le Putois.—*M. flavo-nigricans, ore et auricularum apicibus albis.*

(v. WILDUNGEN *Taschenbuch*, f. 1801.)

In the same countries as the Martin, and also in Barbary. The whole animal, and even its skin when flayed, have a very disagreeable smell.

The Ferret (*furo*). *Ger.* das Frettel. *Fr.* le Furet. Of a yellowish white colour with red pupils, is a true Albino of its kind, consequently not an originally distinct species, but merely a variety of the Polecat, with which it breeds. It is employed for catching Rats and Rabbits.

4. *Zibellina*. The Sable. *Ger.* der Zobel. *Fr.* la Zibeline.—*M. corpore fulvo-nigricante, facie et gula cinereis.*

(SCHREBER. Tab. 136.)

Principally in Siberia. The finest, with a perfectly black brown, thick and glossy fur, are found in the neighbourhood of Jakuzk.

6. *Erminea*. The Ermine. *Ger.* das grosse Wiesel, Hermelin. *Fr.* l'Hermine.—*M. caudæ apice nigro.*

(v. WILDUNGEN *Taschenbuch*, f. 1802.)

In the North, particularly in Siberia. Larger than the common Weasel. Like it too, it changes colour, so as to be brown in Summer, but in Winter white. (*Ermine*.)

6. *Vulgaris*. The Weasel. *Ger.* das Gemeine Wiesel. *Fr.* la Belette.—*M. corpore ex rufo fusco subtus albo.*

(v. WILDUNGEN. l. c.)

In the North of Europe and Asia. The mother often carries the young ones in her mouth, and hence the saying that they enter the world in the same way.

22. *URSUS*. Dentes *primores* superiores 6, intus excavati alterni, inferiores 6, laterales 2, longiores lobati; *laniarii* primarii solitarii (minimi 1—2 inter hos et primos molares,) lingua læva.

1. *Arctos*. The Bear. *Ger.* der Bär. *Fr.* l'Ours.—*U. fusco nigricans*, cauda abrupta.

(*Abbild. Nat. Hist. Gegenst.* Tab. 32.)

In the northern parts of the world, and also in the East Indies, and North Africa. When young, lives principally on vegetables, but after its third year becomes carnivorous. In fighting it makes more use of its fore paws than of its teeth. When full grown, it often weighs upwards of four hundred weight.

Amongst the most remarkable varieties are the great black Ant-Bear; the small light brown Honey-Bear; and the still smaller white Silver-Bear; all shaggy, and with long hair particularly under the neck.

On the contrary, the North American Bear, with black, smooth, satin-like hair, and a flat head with a pointed snout, is certainly a distinct Species, which feeds commonly on vegetables, and at certain seasons of the year exclusively on Ants.

2. *Maritimus*. (*Glacialis*.) The White Bear, Polar Bear. *Ger.* der Eisbär. *Fr.* l'Ours blanc.—*U. albus*, collo et rostro elongatis.

(*Abbild. Nat. Hist. Gegenst.* Tab. 33.)

On the coasts and ice islands of the northern parts of the world. It must not be confounded with the white variety of the common bear. It is twelve feet long, and weighs fifteen hundred weight; it swims and dives with great facility, and is almost exclusively carnivorous*.

3. *Gulo*. The Glutton. *Ger.* der Vielfrass. *Fr.* le Glouton.—*U. corpore rufo fusco*, medio dorsi nigro.

(*PALLAS, Spicileg. Zoologic*, 14. Tab. 2.)

In the northern parts of the world, particularly Siberia. Its voracity has given rise to a variety of fables.

The *Wolverene*, (*Ursus luscus*.) from Labrador and Hudson's Bay, appears to differ but little from it.

4. *Taxus*. (*Meles*.) The Badger. *Ger.* der Dachs. *Fr.* le Blaireau.—*U. cauda concolore*, abdomine nigro.

(*V. WILDUNGEN Taschenbuch*, f. 1797.)

* Much remarkable information relative to this and other animals of Labrador, may be found in G. CARTWRIGHT'S *Journal during a Residence of nearly sixteen years on the Coast of Labrador*. Newark, 1792. 3 Vols. 4to.

In Europe and Asia, as far as China. An omnivorous animal. Makes a deep burrow under ground, with various passages, or galleries, leading to it. Sleeps during the greatest part of its life, and has in particular a long profound Winter sleep, during which it places its snout in a pouch on the fundament.

5. *Mellivorus*. The Honey Bear. *Ger.* der Honig-Dachs.—*U.* dorso cinereo, fascia laterali nigra, abdomine nigro.

(SPARRMANN in den *Schwed. Abhandl.* 1777. Tab. 4. fig. 3.)

At the Cape; lives on the honey and wax of the wild Bees, which fix themselves in the holes of the Porcupine, &c. It either notices the course of the Bees when returning home, or only follows the indication of the *Cuculus Indicator* (Honey Cuckoo). It has a shaggy fur, with an uncommonly thick and lax skin, by which it is defended alike from the stings of bees and the teeth of dogs.

6. *Lotor*. The Racoon. *Ger.* der Wasch-bär. *Fr.* le Raton.—*U.* cauda annulata, fascia palpebrarum transversa linigra. (*Abbild. Nat. Hist. Gegenst.* Tab. 62.)

A nocturnal animal, inhabiting the warmer parts of the north-east of North America; feeds on a variety of substances; uses its fore-paws very dexterously for seizing, or even soaking and fishing up its food, &c *. It is in general very tame. Its hair is esteemed by the hatters next to that of the Beaver.

23. *CANIS*. *Dentes primores superiores* 6, *laterales longiores distantes*, *intermedii lobati*; *inferiores* 6, *laterales lobati omnes*; *laniarii solitarii*, *incurvati*.

1. *Familiaris*. The Dog. *Ger.* der Hund. *Fr.* le Chien.—*C.* cauda recurvata; subinde digito spurio ad pedes posticos.

This faithful companion of man, distinguished for the acuteness of his senses, for his great docility and important services, has long been dispersed with him over all the five portions of the globe, and furnishes the best proof of the perfectibility of animals, when their faculties have been exercised during a long series of generations.

It is difficult to decide whether the different races of dogs are varieties of one and the same species; and whether they are derived from the wolf or the jackal. Many of the races, the turnspit and greyhound for instance, appear to me to have peculiarities adapted to particular functions, which I can hardly

* I have often observed this in one which I had alive for several years, as did also OE. WORMIUS, LINNÆUS, ROLOF, BUFFON, SCHULZE, GÖTZE, BECHSTEIN. and many others.

consider to be the accidental consequences of mere degeneration.

Among the principal Races are :—

(a.) *Fricator*. The Pug-dog. *Ger.* der Mops. *Fr.* le Doguin; with a short, thick-set body, black spots on the cheeks, and pendant ears.—The Bull-dog, *Molossus*. *Ger.* Bullenbeisser. *Fr.* le Bouldogue, in which the lower projects beyond the upper jaw, appears to form the connexion between this and the next race.

(b.) *Mastivus*. The Mastiff. *Ger.* die Englische Dogge. *Fr.* le Dogue, with a short head, flaccid, pendant, upper lip, and smooth hair. Its bark is short and deep. The Butcher's dog, *Ger.* Metzgerhund, appears very closely allied to it.

(c.) *Terræ Novæ*. The Newfoundland. *Ger.* der Newfundländer. (*Abbild. Nat. Hist. Gegenst.* Tab. 6.) It is distinguished by its unusual size, its long silky hair, its shaggy tail curved upwards, and particularly by the sort of web between its toes, which is much larger than in other dogs. Hence it swims with great facility. It is for the most part black and white, and very docile.

(d.) *Sagax*. (*Venaticus*.) The Hound. *Ger.* der Jagdhund. *Fr.* le Chien courant; with a long thick body, depressed vertex, long pendant ears; the hair is sometimes smooth, sometimes shaggy. Here also belong the Spanish Pointer, the Setter, and the tiger-spotted Corsican Dog.

(e.) *Aquaticus*. The Water Dog. *Ger.* der Budel. *Fr.* le Barbet; with a short head and woolly hair.

(f.) *Pastoralis*. (*domesticus, villaticus*.) The Shepherd's Dog, the Cur. *Ger.* das Schäferhund. *Fr.* le Chien de Berger, with straight ears and long hair on the under side of the tail. Here also belong the Iceland dog, and the Pomeranian. *Ger.* der Spitz. *Fr.* le Chien-loup, together with the great dog of St. Bernard, and those which the Kamschatkadales employ to draw their sledges. Of the same nature is the dog found in many of the South Sea Islands, which the inhabitants fatten for eating, and which lives wholly on vegetable food.

(g.) *Meliteus*. The Lap-dog. *Ger.* das Bologneser hündchen. *Fr.* l'Epagneul; with very long silky hair, especially on the face.

(h.) *Vertagus*. The Turnspit. *Ger.* der Dachshund. *Fr.* le Basset. With a long muzzle, hanging ears, elongated body, short crooked fore legs, and reddish brown spots under the

eyes.—The English Terrier (*Terrarius*), with bristly hair and rough muzzle, appears closely connected with it.

(i.) *Dingo*. The New Holland Dog. Rather resembles the Fox, particularly in the form of the head and tail.

(k.) *Leporarius*. The Greyhound. *Ger.* das Windspiel. *Fr.* le Levrier. With a long pointed head, hanging ears, deep chest, very slender body and legs.

(l.) *Graius* *, (*Canis Laconicus*) very large; intermediate in form between the Hound and Greyhound. The great Danish dog, and the great Irish dog (Wolf-dog), now extinct, are similar to this.

(m.) *Ægyptius*. The Indian Dog. *Ger.* der Guineische Hund. *Fr.* le Chien-Turc, resembles the Greyhound, but has hair only on the face, the rest of the body being bare, and black or dark brown, almost like a Negro's skin.—See *Remark* 2. to § 16.

These Races of Dogs copulate not only with one another, but also with the Wolf and Fox, occasionally producing a fertile progeny.

2. *Lupus*. The Wolf. *Ger.* der Wolf. *Fr.* le Loup.—*C. cauda incurvata*.

(v. WILDUNGEN *Taschenbuch*, f. 1795.)

In almost the whole of the Old World; but has been extirpated in some countries, as Great Britain and Ireland. Has a lounging, though at the same time quick pace, and is not readily tired. When hungry, the Wolf eats reeds, and even earth; it digs up newly buried bodies, and probably its appearance in church-yards at night may have given rise to the stories of the *Man-Wolf*. (*Währ-Wolf*. *Loup-garou*.)

3. *Aureus*. The Jackal. *Ger.* der Schakal. *Fr.* le Chacal.—*C. corpore fulvo, pedibus longioribus, caudæ apice nigro*.

(SCHREBER. *Tab.* 94.)

In North Africa, and in the East, particularly Natolia and Bengal; prowls by night in troops; eats other animals, leather, &c.; and digs up dead bodies. Many Naturalists consider the Jackal as the original stock of the Dog; and many Commentators have supposed that it is the Fox of Samson.

4. *Vulpes*. The Fox. *Ger.* der Fuchs. *Fr.* le Renard.—*C. cauda recta, apice discolore*.

(v. WILDUNGEN *Taschenbuch*, f. 1796.)

* This name was given by RAY, LINNÆUS, &c., to the true Greyhound, with which, however, the ancient Grecians do not appear to have been acquainted.

Principally in the northern parts of the Old World. In vast numbers on the eastern Aleutian, or as they have been thence named, Fox Islands. Among other fruit, is very fond of grapes.

The *Alopex* (*Brandfuchs*.) is certainly only a Variety. It is not, however, so easy at once to decide whether the black Fox with a white tipped tail, so much valued for its fur, be a variety, or a distinct species : it is found in Siberia, and in great numbers in Labrador ; and when the hair is silver white at its extremities, is called the Silver Fox *.

5. *Lagopus*. (Isatis.) The Arctic Fox. *Ger.* der weisse Fuchs, Polar Fuchs. *Russ.* Pesez.—*C. cauda recta*, apice concolore, palmis plantisque pilosissimis.

(SCHREBER. Tab. 93 A. 93 B.)

In the Polar regions, particularly Spitzbergen, Nova Zembla, Greenland, &c. Most of them are white. The so called Blue Fox, on the contrary, bluish grey.

6. *Hyæna*. The Hyæna.—*C. nigricans*, maculis virgatis, facie nigra, juba cervicis dorsique, pedibus tetradactylis. Mostly in the same regions with the Jackal, which it also resembles in its mode of life : has its den under ground, or in cavities of rocks, &c.

The Spotted Hyæna (*Canis crocuta*.) is much larger† than the striped ; it is met with in great numbers in Abyssinia, and thence southward to the Cape. Both of them approximate in their structure to the next genus.

24. *FELIS*. Ungues retractiles, caput rotundius, lingua aspera. Dentes primores 6 ; acutiusculi, exterioribus majoribus ; *laniarii* solitarii, supra a primoribus, infra a molaribus remoti.

1. *Leo*. The Lion. *Ger.* der Löwe. *Fr.* le Lion.—*F. cauda elongata floccosa* ‡, corpore fulvo.

* An unusually fine skin of a Labrador Silver Fox has been sold in London for 500 dollars, or even more.

† A Lioness, ten years old, which I dissected some years ago, measured from the nose to the beginning of the tail, four feet ten inches ; and a spotted Hyæna, not full grown, described in Lord VALENTIA'S *Travels*, measured in the same way, four feet three inches. A very perfect skull of the same animal, with which M. Von WILDUNGEN enriched my Collection, as at least as large as that of the Lioness already mentioned.

‡ The old Scholiasts on HOMER (*Iliad*, 20-170.), speak of a prickle at the end of the Lion's tail ; and, in fact, in the same Lioness I found something of that kind, which I have described and figured in my *Specimen Historiæ Naturalis ex auctoribus classicis illustratæ*.

(SCHREBER. Tab. 97 A. 97 B.)

In the warmer regions of the Old World, particularly in Africa, occasionally also in Peloponnesus and Etolia. In recent times, too, Lionesses in Menageries have produced young, in Germany and other of the temperate parts of Europe. The mane of the male first appears in its second year. The flesh of the Lion is eaten by the Hottentots, and a tribe of Arabs, between Tunis and Algiers, live almost entirely upon it.

2. *Tigris*. The Tiger. *Ger.* der Tiger. *Fr.* le Tigre.—F. cauda elongata, corpore et cruribus nigro-virgatis.

(The TIGER, by G. STUBBS.)

Found in Asia only, and there principally from Bengal to China, also in Sumatra, &c. It is striped with great regularity. It may certainly be tamed, and yields to the Elephant.

3. *Pardus*. The Panther*. *Ger.* der Panther, Parder. *Fr.* la Panthère.—F. cauda subelongata, maculis obtuse angulatis, passim confluentibus et annulatis.

(SCHREBER. Tab. 99.)

In Africa and the East Indies. The spots on its fur, occasionally run into one another in a horse-shoe, ring-shape, &c.

The Leopard is a Variety; is somewhat smaller, and with smaller spots, which are mostly placed three or four together on a golden yellow ground.

4. *Panthera*. The Ounce. *Ger.* der kleine Panther. *Fr.* l'Ounce.—F. cauda elongata, corpore albido, maculis irregularibus nigris.

(SCHREBER. Tab. 100.)

In Barbary and the East Indies. Much smaller than the preceding species. Easily tamed and trained to the chase of deer, the Gazelle, &c. for which purpose it has long been employed in the East, and also during the middle ages in Italy and France.

5. *Onça*. The Jaguar. (American Tiger.) F. cauda subelongata, corpore fusco lutescente, maculis angulatis, ocellatis, medio flavis.

(SCHREBER. Tab. 102.)

In South America. Larger than the Panther, which it otherwise resembles.

* The fur-dealers call all skins of animals of this Genus, with ring-shaped spots, Panther; and on the contrary, all those in which the spots are of other forms, Tiger.

6. *Concolor*. The Puma, Cougar. (American Lion.)—F. cauda mediocri, corpore immaculato fulvo.

(SCHREBER. Tab. 104.)

In Peru, Brazil, &c. Distinguished by its reddish yellow skin without spots, (whence it has been called Lion,) and its small head.

7. *Lynx*. The Mountain Cat. Lynx. Ger. der Luchs. Fr. le Loup-Cervier.—F. cauda abbreviata, apice atro, auriculis apice barbatis, corpore maculato, plantis palmisque amplissimis.

(v. WILDUNGEN *Taschenbuch*, f. 1800.)

In the northern parts of the world, common also in the kingdom of Naples; does more mischief among game than even the wolf.

8. *Catus*. The Cat. Ger. die Katze. Fr. le Chat.—F. cauda elongata, striis dorsalibus longitudinalibus, lateralibus spiralibus.

In almost the whole of the Old World, and from thence introduced into America by the Spaniards. The wild animal (v. WILDUNGEN *Taschenbuch*, f. 1799.) is larger than the tame, and of a greyish-red colour, with the lips and soles of the feet black. The domestic Cat very rarely copulates under the eye of man, and quickly becomes wild when it has accidentally escaped. Among the peculiarities of the Cat, are its powerful electricity; the shining of its eyes in the dark; its singular love of certain plants, such as the *Nepeta cataria*, the *Teucrium marum*, &c.; its purring; and the strong and invincible antipathy of many individuals to it, &c. Among the principal varieties are the Angora or Persian cat, with long, silky hair, which is commonly hard of hearing; the bluish-grey Carthusian or Cyprus cat; and the Spanish or Tortoise-shell cat: of the latter, the females are often found of three colours, (for instance, black, white, and yellowish brown,) equally distributed in large spots, while on the contrary, this is very rarely the case with the males.

(C.) BRUTA.

Without teeth, or at least without front teeth.

25. *BADYPUS*. Sloth. Ger. Faulthier. Fr. Paresseux.—Caput rotundatum, crura antica longiora. Dentes primores nulli utrinque; laniarii (?) obtusi, solitarii; molares cylindrici, obtusi.

1. *Tridactylus*. The Aï.—B. pedibus tridactylis, cauda brevi.

(*Abbild. Nat. Hist. Gegenst. Tab. 53.*)

In Guiana, &c. An extremely inactive, unwieldy animal, but with all its laziness, cunning, and on necessity, bold and strong; it is extremely tenacious of life, and has very few wants. It feeds on leaves, and scarcely ever drinks.

26. *ORYCTEROPUS*. Caput productum rostratum. Cauda elongata conica. Palmæ tetradactylæ, plantæ pentadactylæ. Dentes primores et laniarii nulli; molares infra 4, supra 5.

1. *Capensis*. (*Myrmecophaga Capensis*.) Cape Ant-Eater. Ger. das Erdschwein.

(*BUFFON Supplement, Vol. VI. Tab. 31.*)

At the Cape, and formerly classed among the Ant-Eaters, but improperly. A large and nocturnal animal, which burrows in the ground with its powerful claws.

27. *MYRMECOPHAGA*. Ant-Eater. Ger. Ameisen-bär. Fr. Fourmillier. Rostrum productius, lingua lumbriciformis; dentes nulli.

1. *Jubata*. Ger. der grosse Tamandua.—*M. palmis tetradactylis*, cauda longa jubata.

(*Abbild. Nat. Hist. Gegenst. Tab. 82.*)

Principally in Brazil. About as big in the body as a butcher's dog. In the wild state, it, together with the following small species, lives entirely on the large Ants of the countries they inhabit.

2. *Didactyla*. The Two-toed Ant-Eater. Ger. der kleine Tamandua.—*M. palmis didactylis*; ungue exteriore maximo, plantis tetradactylis; cauda prehensili.

(*Abbild. Nat. Hist. Gegenst. Tab. 22.*)

Likewise in South America; of the size and almost of the colour of a squirrel.

28. *MANIS*. Scaly Ant-Eater. Ger. Schuppenthier.—Formosanisches Teufelchen. Corpus squamis tectum; lingua teres; dentes nulli.

Their external covering excepted, the animals of this Genus present considerable analogy in their form, mode of life, &c. to the true Ant-Eaters. By many of the older naturalists, they were classed among Lizards.

1. *Tetradactyla*. The four-toed Manis; Scaly Lizard. Ger. Phatagin.—*M. cauda longiore*; ungulis bifidis.

(*Abbild. Nat. Hist. Gegenst. Tab. 14.*)

From Formosa and the neighbouring parts of Asia. About

the size of the Two-toed Ant-Eater. Its chesnut brown and scaly body resembles a fir cone.

29. *TATU*. (*Dasyus*. LINN.) Armadillo. Ger. Panzerthier, Gürtelthier.—*Corpus testis zonisque osseis cataphractum*; *dentes primores et laniarii nulli*.

1. *Novemcinctus*. Nine banded Armadillo. Ger. der Caschicame.—*T. zonis dorsalibus 9*; *palmis tetradactylis*; *plantis pentadactylis*.

(*Abbild. Nat. Hist. Gegenst.* Tab. 83.)

In South America, as far as Magellan's Strait. Burrows under ground, and, like the Manis and Hedgehog, rolls itself into a ball when attacked.

V. SOLIDUNGULA.

Animals with hoofs. A single Genus containing but a few Species.

30. *EQUUS*. *Pedes ungula indivisa, cauda setosa. Dentes 6, primores superiores 6, obtuse truncati; inferiores prominentiores; laniarii solitarii utrinque remoti.*

1. *Caballus*. The Horse. Ger. das Pferd. Fr. le Cheval.—*E. cauda undique setosa.*

The original Wild Horse no longer exists; but that which has become so, is often met with in great numbers; in Tartary, for example, and in immense droves in Paraguay, whither, as well as into the rest of America, it was introduced by the Spaniards. Among the tame races, the Arabians, (particularly those of the breed of Annecy, about Palmyra, and from Libanus to Mount Horeb,) are distinguished by their wonderfully fine form, as well as their extreme speed and vigour. Next to them, are the Persian and the Barb. Of the European, the principal are the Spanish, particularly the Andalusian, the Neapolitan and the English. The latter have the pre-eminence in point of speed, for which they are distinguished in their Prize Races. The English race-horse, *Eclipse*, so famed in modern times, passed over fifty-eight feet in a second; i.e. when at full stretch, he covered twenty-five feet, and repeated this action twice and one-third ($2\frac{1}{3}$) in a second*. Not to mention whole equestrian nations, as the COSSACKS, TATARS, CALMUCKS, TUNGOOSES, ABIPONES, &c., the value of this animal to the most cultivated people is incalculable for agriculture, cavalry, posts, &c.

* See an Essay on the Proportions of *Eclipse*, in the Works of CH. VIAL DE SAINBEL, London, 1795. 4to.

Many of the equestrian nations above-mentioned, live in great part on the flesh and milk of the Horse. The latter when coagulated, and still more so when distilled, gives the intoxicating Koumiss of the Mongols.

2. *Asinus*. The Ass. *Ger.* der Esel. *Fr.* l'Ane.—*E. cauda extremitate setosa, cruse dorsali nigra.*

The Wild Ass, from which the tame animal is derived, is the true *Onager* of the ancients; it is found at present principally in Tartary, under the name of *Kulan**, from whence it emigrates in the Autumn of every year in droves, southwards towards Persia and India, where it passes the Winter. It is longer and lighter than the domestic Ass, and possesses much greater speed. The Ass has not yet been introduced into the more northern parts of Europe. It degenerates but little; at most somewhat in colour; for instance, there are white Asses.

The Horse and Ass copulate together, and produce two kinds of Bastards of great strength, and occasionally, though rarely, fertile. One is the common *Mule* (*mulus*). *Ger.* Maulthier. *Fr.* Mulet†, bred between the Mare and the Male Ass. The other is the *Hinnus*. (*Ger.* Maul Esel. *Fr.* Bardeau‡,) between the Stallion and the She-Ass. The latter is the most uncommon, and has given rise to the fables of *Jumars*, or supposed Bastards between the Horse and Ox.

3. *Zebra*. The Zebra.—*E. zonis fuscis et albidis, maxime regularibus.*

The Zebra, of which there are two distinct species, that have been improperly considered as the male and female of a single one, is a native of South Africa. It lives in herds, is uncommonly swift, but wild and intractable. When tamed, the female has produced Bastards, with the male of both the Horse and Ass||.

VI. BISULCA. (*Pecora*).

Ruminating animals with cloven feet, including the most valuable domestic animals.

31. *CAMELUS*. *Cornua nulla, labium leporinum, pedes sub-bisulci* §. *Dentes primores inferiores 6, spathi-*

* PALLAS in *Act. Acad. Petropol.* 1777, P. 2. p. 238, &c.

† BUFFON *Supplemen.* Vol. 3. Tab. 1. ‡ *Id. loc. cit.* Tab. 2.

|| SIR JOSEPH BANKS in *Nicholson's Journal of Natural Philosophy*, Vol. II. pp. 2-67. § LEVITICUS, Chap. ii. verse 4.

formes ; superiores 2 ; *laniarii* distantes, superiores 3, inferiores 2.

1. *Dromedarius*. The Dromedary *. *Ger.* das gemeine Camel. *Fr.* le Dromadaire.—*E.* tofo dorsi unico.

(SCHREBER. Tab. 303.)

Is still occasionally found wild in Asia, particularly in the deserts between China and India, but has become a most important domestic animal throughout the East and in the northern and middle parts of Africa ; (the *Ship of the Desert*, as the Arabs call it). The common load of the Caravan Camels is about six hundred weight, and their day's journey, about four German miles. This useful animal eats the thorny shrubs which grow in abundance in the Desert, and on which no other animal could exist. We are told also, that it can endure thirst for several weeks, drinking, however, a vast quantity at one time. This, as well as the next species, has a large callus on the front of the breast, four smaller ones on the front, and two on the hind legs, on which they support themselves in lying down when fatigued.

2. *Bactrianus*. The Camel. *Ger.* das Trampelthier. *Fr.* le Chameau.—*C.* tofis dorsi duobus.

(SCHREBER. Tab. 304.)

In the middle of Asia as far as China, particularly in large herds in Bessarabia, &c. It is employed as a beast of burden, more than the preceding species, on account of its quick pace, and natural saddle.

3. *Llama*. The Llama. *Ger.* die Camelziege. *Fr.* le Lama.—*C.* dorso lævi. tofo pectorali.

(SCHREBER. Tab. 306.)

Together with the next species in South America, particularly in the mountainous parts of Peru. It is employed as a beast of burden, and though of moderate size, will carry a hundred weight and a half.

3. *Vicuna*. The Vicugna. *Ger.* das Shafcamel. *Fr.* le Vigue.—*C.* tofis nullis, corpore lanato.

(SCHREBER. Tab. 307.)

Smaller than the Llama. Cannot be tamed, but is taken every year in great numbers for the sake of its cinnamon-brown hair, which gives the well-known Vicugna wool. The western Bezoar is also most commonly found in this species.

* It is, by many writers and travellers, called the Camel with two humps.

32. *CAPRA*. *Cornua cava rugosa scabra. Dentes primores superiores nulli, inferiores 8, lanarii nulli.*

1. *Ovis*. The Sheep. *Ger. das Schaf, Fr. le Brebis.*—*C. mento imberbi, cornibus compressis lunatis.*

Is no longer found originally wild; neither, as it seems, does it ever *become* wild, like the goat. It is considered throughout the whole of the Old World, as one of the most useful domestic animals, and was introduced into America soon after its discovery.

Of the different Races of Sheep, the most remarkable are the Spanish, from Segovia, and also the English, for their fine wool; the Iceland, with four, six, or eight horns; and the Arabian and Egyptian, with fat tails, weighing 40 lbs. The Marsh-sheep of East Friesland are without horns; the Lunenberg Heath-sheep, on the contrary, small, and with horns in both sexes. Those between the Tropics have, for the most part, smooth goat-like hair instead of wool; and in South Africa, long pendant ears in addition.

2. *Ammon*. The Moufflon. *Ger. das Muffelthier. (BUFFON'S Moufflon).*—*C. cornibus arcuatis circumflexis subtus planiusculis, palearibus laxis pilosis.*

(SCHREBER. Tab. 268.)

In Corsica and Sardinia, Greece and Barbary; a similar, but much larger kind (the *Argali*,) is found in Siberia, as far as Kamschatka, and in the north-west of America. The latter forms very high-flavoured game; has very large heavy horns*; and is considered by many Naturalists as the original stock of our common sheep.

3. *Hircus*. The Goat. *Ger. die Ziege. Fr. le Chèvre.*—*C. mento barbato, cornibus arcuatis carinatis.*

The domestic Goat appears to be derived from the *Ægagrus* of Caucasus, and the mountains to the East, and in the stomach of which, (as well as of many species of Antelope,) the Oriental Bezoar stone is found, from which circumstance the animal has received the name of Bezoar Goat†. The domestic Goat (an important animal to the ancient Guanches of the Canary Islands,) easily becomes wild again, and is now almost as extensively dispersed through the world as the sheep. The

* A single and imperfect horn of this kind in the Academical Museum, of Göttingen, weighs full nine pounds.

† PALLAS *Spicileg. Zoolog.* 11 Tab. 5. fig. 2, 3.

Angora Goat (*Ger.* Kämmlthier,) has long silky hair ; and from the extremely fine woolly hair, which the small but handsome straight-horned goats of Thibet and Cashmire have under their long and coarse coat of hair, are manufactured the costly shawls of those lands of paradise*.

4. *Ibex*. The Wild Goat. *Ger.* der Steinbock. *Fr.* le Bouquetin.—*C. mento barbato, cornibus lunatis maximis, supra nodosis, in dorsum reclinatis.*

(*V. WILDUNGEN Taschenbuch, f. 1803.*)

(*MEISNER'S Museum der N. G. Helvetiens. No. 1—5.*)

On the highest snowy mountains of Savoy, and the Siberian Alps. The horns of the full-grown Ibex weigh full 8lbs, and have commonly the same number of knotty rings on each side.

33. *ANTILOPE*. *Cornu cava, teretia, annulata, vel spiralia. Dentes ut in capris.*

An extensive genus, of which the numerous species are found in the middle and south of Asia and Africa, but particularly at the Cape.

1. *Rupicapra*. The Chamois. *Ger.* die Gemse. *Fr.* le Chamois. l'Izard.—*A. cornibus erectis uncinatis.*

(*V. WILDUNGEN Taschenbuch, f. 1803.*)

In the Alpine regions of the temperate parts of Europe and the west of Asia. When tamed, it has copulated and produced bastards with the goat. The concretions (*ægagropilæ*), formerly so much esteemed, are formed of the indigestible fibres of its food.

2. *Dorcas*. The Gazelle.—*A. cornibus teretibus annulatis, medio flexis, apicibus lævibus approximatis.*

(*SCHREBER. Tab. 269.*)

Throughout the East, and in North Africa. This light and active animal is the favourite object of chase for the Eastern nations, and has afforded their poets an object of comparison for female beauty.

3. *Pygarga*. The White-faced Antelope. *Ger.* der Springbock. *Fr.* la Gazelle de parade.—*A. cornibus liratis, linea laterali faciei et trunci fusca, clunibus albis.*

(*VOSMAER, Descr. de la Gazelle de parade, —.*)

In the interior of South Africa, whence it passes every year in great herds towards the Cape, and returns after a few months.

4. *Oreas*. *Ger.* das Cudu.—*A. cornibus subulatis rectis carinato-contortis, corpore griseo.*

* I have given a notice of these beautiful Shawl-Goats in the *Götting. Taschenbuch*, for 1813.

(VOSMAER, *Descr. d'un Animal appelé Canna.*)

In South Africa and the East Indies. The form and length of its straight horns resemble that of the fabulous Unicorn, to which it probably gave origin.

34. *Bos*.—*Cornua concava, lunata, lævia. Dentes ut in generibus præcedentibus.*

1. *Taurus*. The Ox. *Ger.* der Ochse. *Fr.* le Boeuf.—*B. cornibus teretibus extrorsum curvatis, palearibus laxis.*

The Auerochs (Urus, Bonassus and Bison of the Old World,) is still found in Poland, Lithuania, and Siberia, and was formerly an inhabitant of Germany. It is not probable, however, on account of certain peculiarities in its structure, that it is the stock of our tame cattle. Among the most remarkable varieties of the latter are the half wild race, white, with brown or black ears, from the Ladrones, and in some parts of Great Britain; the Sicilian, with extremely large horns; those of some parts of England without horns. On the other hand, it is doubtful, if the Indian Ox, *Bos Indicus*, or Zebu, (SCHREBER. Tab. 298.) considered sacred by the Hindoos, be a mere variety of this species.

Balls of hair, which they have licked and swallowed, are occasionally found in the stomach of horned cattle. The frightful and pestilential epidemy peculiar to them has frequently prevailed to a great extent since 1711. On the contrary, the cow-pox was, in 1798, proved by Dr. JENNER, to be an efficient preservative from small-pox.

2. *Buffelus*. The Buffalo. *Ger.* der Büffel. *Fr.* le Buffle.—*B. cornibus resupinatis intortis antice planis.*

(SCHREBER. Tab. 300.)

It comes originally from Thibet, but has gradually spread through the greater part of Asia and North Africa, also occasionally in Europe, as, since the seventh Century in Italy, Hungary, and the Salzburg, being used for draught. Its skin is black, strong, and with a few hairs.

3. *Grunniens*. The Grunting Bull. *Ger.* der Büffel mit dem Pferde-schweif. *Fr.* le Buffle á queue de Cheval.—*B. cornibus teretibus, introrsum curvatis, vellere propendente, cauda unique jubata.*

(*Abbild. Nat. Hist. Gegenst.* Tab. 23.)

Also a native of Thibet, but domesticated in Hindostan. Smaller than our horned cattle; distinguished also by its grunting voice, by its shaggy, goat-like hair, and by its bushy long-haired tail,

which, when it is fine, is of considerable estimation and value in India.

4. *Arni*. *Arni*. *Ger.* der Kiesenbuffel.—*B. cornibus divaricatis, lunatis, longissimis.*

(*Abbild. Nat. Hist. Gegenst.* Tab. 63.)

In the mountainous regions of the north of Hindostan; immensely large, so that a young one weighs 1500 weight.

5. *Bison*. The Bison of North America.—*B. cornibus divaricatis brevibus, juba longissima, dorso gibboso.*

(*SCHREBER.* Tab. 296.)

The largest land animal of the New World; lives in herds in the marshy woods of the temperate parts of North America. In Winter its whole body is covered with hair, but in Spring its back and the hinder parts of the body become bare, only the great mane of the breast and neck remaining.

6. *Moschatus*. The Musk Ox. *Ger.* der Bisamstier. *Fr.* le Bœuf musqué.—*B. cornibus deflexis, basibus latissimis complanatis ad frontem contiguis; apicibus reflexis.*

(*SCHREBER.* Tab. 302.)

It is confined to the extremity of North America, on the west of Hudson's Bay, from 66° to 73° of north latitude. Two of its horns will sometimes weigh upwards of half a hundred weight.

35. *GIRAFFA*. *Cornua simplicissima pelle tecta, fasciculo pilorum nigro terminata. Dentes primores superiores nulli; inferiores 8 spathulati, extimo bilobo; lanarii nulli.*

1. *Camelopardalis*. The Giraffe.

(*CARTERET in Phil. Trans.* Vol. LX. Tab. 1.)

In the interior of Africa. It has a very peculiar appearance on account of its long neck, short body, sloping back, and reddish, beautifully spotted skin. In walking, it moves the fore and hind foot of the same side together, like an ambling horse, from which circumstance it has a very remarkable motion, whence that of the Knight at chess is derived: when it stands upright, it is more than sixteen feet high.

36. *CERVUS*. *Cornua solida multifida. Dentes ut in generibus præcedentibus (interdum tamen lanarii solitarii superiores).*

1. *Alces*. The Elk. *Ger.* das Elennthier. *Fr.* l'Elan.—*C. Cornibus planis acaulibus, palmatis.*

(*v. WILDUNGEN Taschenbuch, f. 1805.*)

In the whole northern World, unless the Moose-Deer *, (*Ger.* Nord-Amerikanische Elenn, *Fr.* l'Original,) be a distinct species; has very long legs; reaches the size of a horse, weighs upwards of 1200lbs, and its horns upwards of 50; can be tamed and driven in herds to pasturage. The old assertion, that the Elk is often attacked by Epilepsy, &c., needs no refutation.

2. *Dama*. The Fallow-Deer. *Ger.* der Damhirsch. *Fr.* le Daim.—*C. cornibus subramosis compressis, summitate palmata.*

(v. *WILDUNGEN Taschenbuch*, f. 1796.)

In the milder regions of Europe. Smaller than the common stag: varies in colour.

3. *Tarandus*. The Rein-deer. *Ger.* das Renthier. *Fr.* le Renne.—*C. cornibus (in utroque sexu) longis, simplicibus, teretibus summitatibus subpalmatis, juba gulari pendula.*

(v. *WILDUNGEN Taschenbuch*, f. 1805.)

In all the northern parts of the world; sometimes, as in Kamtschatka, in herds of a thousand or more; it cannot exist in warm climates; lives on dry leaves, and particularly on the Rein-deer moss, which it scrapes from under the snow. It furnishes the Laplanders, Samoides, Tungooses, and Koraks, with the means of supplying their most urgent wants.

4. *Elaphus*. The Stag. *Ger.* der Edel-hirsch. *Fr.* le Cerf.—*C. cornibus ramosis totis teretibus, recurvatis apicibus multifidis.*

(v. *WILDUNGEN Taschenbuch*, f. 1794.)

A native of nearly the same regions with the Elk, but extending more southwards. The number of points to the horns does not exactly correspond to the age of the animal; after the eighth year it becomes uncertain. The largest and finest horns have very seldom more than twenty-four true points. The Stag lives about thirty years, or somewhat more.

5. *Capreolus*. The Roe. *Ger.* das Reh. *Fr.* le Chevreuil.—*C. cornibus ramosis, teretibus, erectis, summitate bifida.*

(v. *WILDUNGEN Taschenbuch*, f. 1797.)

In the temperate and warmer countries of Europe and Asia. The horns of the Roe-buck are more frequently disfigured by exostoses, particularly after castration, than those of other species of this genus.

* *Jo. Fr. MILLER*, Fasc. 2. Tab. 10.

37. *Moschus*. Cornua nullā. Dentes *primores* ut in præcedentibus generibus; *laniarii* superiores solitarii exserti.

1. *Moschifer*. The Musk. Ger. das Bisamthier. Fr. le Musc.—M. folliculo umbilicali.

(SCHREBER. Tab. 242.)

In the pine forests and mountainous regions of Thibet, and the south of Siberia. The male has a bag near the navel, almost as large as a hen's egg, and containing the musk, so valuable as a medicine.

2. *Pygmæus*. The Pigmy Musk. Ger. das Kleine Guineische Rehchen. Fr. le Chevrotain.—M. supra fusco-rufus, sub-tus albus, ungulis succenturiatis nullis.

(SEBA. *Thes.* 1. Tab. 45. fig. 1.)

In Guinea and the East Indies. The smallest animal of this Order. Its legs are not longer than a finger, and about as thick as a pipe stem.

VII. MULTUNGULA. (BELLUÆ.)

Mammifera of large size, unshapely, with bristles or few hairs, and with more than two toes on each foot. To this Order also belong swine, which have in fact four toes.

38. *Sus*. Rostrum truncatum, prominens, mobile. Dentes *primores* (plerisque) superiores 4, convergentes, inferiores 6, prominentes; *laniarii* superiores 2, inferiores 2, exserti.

1. *Scrofa*. The Wild Boar. The Hog. Ger. das Wilde Schwein; das zahme Schwein. Fr. le Sanglier; le Cochon.—S. dorso setoso, cauda pilosa.

The Wild Boar. (v. WILDUNGEN *Taschenbuch*, f. 1795.) has a longer snout than the tame swine; the form of the skull is different, the ears shorter and erect, the tusks larger; it never has hydatids, and is almost always of a blackish grey colour.

Few animals are so generally dispersed through the whole world as the Domestic Hog. Its sense of smell is uncommonly acute, and it is nearly omnivorous. The Sow frequently produces young twice in the year, and often as many as twenty at once. The Hog has become partly wild in America, whither it was introduced from Europe. (Fr. *Cechons Marrons*.) In Cuba they are as large again as their European stock; in Cubagua they have degenerated into an extraordinary Race, with toes half a span long, &c. The Chinese (Fr. *Cochons de Siam*.) have

shorter legs, and the back arched, without any mane. A Variety is not uncommonly met with in Sweden and Hungary, with an undivided foot, and was known to the ancients, as well as that with five toes.

2. *Æthiopicus*. African Hog. Emgallo. *Fr.* le Sanglier du Cap Verd. Sanglier de Madagascar.—*S. dentibus primoribus nullis; laniariis superioribus lunatis extrorsum curvatis; sacculis verrucosis sub oculis.*

(*Abbild. Nat. Hist. Gegenst.* Tab. 92.)

In the interior of South Africa, and in Madagascar. A formidable wild animal, with a very large head, a snout a span broad, and large warty folds of skin under the eyes.

3. *Tajassu*. Peccary. *Ger.* das Bisamschwein, Nabelschwein, —*S. cauda nulla, folliculo moschifero ad extremum dorsi.*

(*SCHREBER.* Tab. 325.)

In herds, in the warmer parts of South America. It does not weigh above 60lbs.

4. *Babirussa* *. The Babiroussa.—*S. dentibus laniariis superioribus maximis, parallelis retrorsum arcuatis.*

Particularly in the Molucca Islands. It lives near the water, and can easily swim to islands at a pretty considerable distance. It is difficult to understand the utility of the almost semicircular tusks of the upper jaw: they are much smaller in the female.

39. *TAPIR*. *Dentes primores* utrinque 6, *laniarii* 4, *palmae ungulis* 4, *plantæ ungulis* 3.

1. *Americanus*. The Tapir. (*SCHREBER.* Tab. 319.)

The largest land animal in South America, being of the stature of a middle sized Ox. The head and legs are nearly the same as in the Hog; the upper lip pointed, and very moveable. It commonly sits on its hind feet like a dog. It goes into the water readily, and swims well.

40. *ELEPHAS*. Elephant. *Proboscis longissima, prehensilis; dentes primores superiores exserti.*

1. *Asiaticus*. *E. capite elongato, fronte concava, auriculis minoribus angulosis; dentium molarium corona lineis undulatis parallelis distincta.*

(*Abbild. Nat. Hist. Gegenst.* Tab. 19. fig. B.)

In the south of Asia, particularly Ceylon. The largest of all land animals, being full 15 feet high, and weighing in its 20th

* *Baba*, in the Malay language, means Swine; *russa*, Stag.

year 7000lbs. Its skin, nearly an inch thick on the back, is, notwithstanding, sensible to the stings of insects, and commonly of a grey colour. The most important organ of the Elephant is his proboscis, which serves him for respiration, for his very acute sense of smell, for drawing up water, for seizing his food and conveying it into his mouth, and for many other purposes, instead of a hand. He can extend it to the length of six feet, and shorten it again to three. At the extremity, it is provided with a flexible hook, by means of which he can perform various tricks, such as untying knots, unloosing buckles, picking up money, &c. His food consists principally of the leaves of trees, rice, and other grain. He swims with great facility, even through rapid streams. In copulating, he leaps on the female like most other quadrupeds. The young one sucks with the mouth, and not the trunk as many have asserted. About the third or fourth year, the two large tusks, which furnish ivory, appear in both sexes. They are seven or eight feet long, and a single one will weigh as much as 200lbs. It is probable that the Elephant will live 200 years. It is principally used as a beast of burden, as it is able to carry at least a ton, and to drag heavy articles over mountains, &c. Its step consists in a quick shuffling motion of the legs, but so sure that it never stumbles, even on the worst roads.

2. *Africanus*. E. capite subrotundo, fronte convexa, auriculis amplissimis, rotundatis; dentium molarium corona rhombis distincta.

(Abbild. Nat. Hist. Gegenst. Tab. 19. fig. C.)

This species, a native of the middle and south of Africa, is a domestic animal in the interior only of that Continent; elsewhere it is hunted and killed merely for its flesh, and particularly for procuring ivory.

41. RHINOCEROS. Rhinoceros. Cornu solidum, conicum, naso insidens.

- 1 *Asiaticus*. The One-Horned Rhinoceros—Rh. dentibus primoribus, utrinque quaternis, inferioribus conicis, superioribus sublobatis; laniariis nullis.

(Abbild. Nat. Hist. Gegenst. Tab. 7. fig. B.)

In the East Indies. The (generally) single horn of this species, as well as the double one of the African, is not attached to the bone, but merely rests upon it.

2. *Africanus*. The Two-Horned Rhinoceros.—Rh. dentibus primoribus et laniariis nullis.

(*Abbild. Nat. Hist. Gegenst.* Tab. 7. fig. A.)

In South Africa, at the Cape, &c. For the most part with a double horn; the second small, and placed behind the first.

42. HIPPOPOTAMUS. Dentes primores superiores remoti, inferiores procumbentes; laniarii inferiores incurvati, oblique truncati.

1. *Amphibius*. The River-Horse. Ger. das Nilpferd. Fr. le Cheval marin. (At the Cape, called Sea Cow.)

(*BUFFON. Supplement* Vol. III. Tab. 62, 63. Vol. VI. Tab. 4, 5.)

Common in South Africa; formerly also in the Nile. Extremely unwieldy, with a large unshapely head, an immense mouth, thick body, short thighs, &c. A full grown one weighs at least 3500lbs. It feeds on vegetables and fish.

VIII. PALMATA.

Mammifera with webbed feet, the Genera being divided (as in the order Digitata,) according to the forms of the teeth into three Families. (A.) Glires. (B.) Feræ. (C.) Bruta.

- (A.) Glires. With chisel-shaped gnawing teeth.

43. CASTOR. Pedes postici palmati. Dentes primores utrinque 2.

1. *Fiber*. The Beaver. Ger. der Biber. Fr. le Castor.—C. cauda depressa, ovata, quasi squamosa.

(*Abbild. Nat. Hist. Gegenst.* Tab. 43.)

In the Northern World, in lonely spots near lakes and great rivers. It is valuable to trade for its fine fur, and in medicine for the well known castor which is found in both sexes in a particular receptacle at the extremity of the abdomen. These animals, however, are particularly remarkable for the ingenuity with which they construct their permanent residences, in those countries in which they are still found in numbers together, such as the interior of Canada, and above all, for the wonderful skill with which they make dams when necessary. Allowing that there is much exaggeration in the accounts which many travellers have given of the Beaver, yet the coincident testimony of the most unprejudiced observers from various parts of the world, proves that these animals are capable of directing their operations according to circumstances, in a manner far superior to the unvarying mechanical instinct of other creatures.

(B.) *Feræ*. With the teeth of carnivorous animals.

44. *PHOCA*. *Pedes postici exporrecti, digiti coaliti.*
Dentes primores superiores 6, inferiores 4; laniarii
solitarii.

With the animals of the preceding Genus, as it were the Amphibia of Mammifera, their whole structure being calculated to enable them to exist in both elements *.

1. *Vitulina*. The Seal. *Ger.* der Seehund, die Robbe, das Seekalb. *Fr.* le Veau marin.—*P.* capite lævi, auriculis nullis, corpore griseo.

(*Abbild Nat. Hist. Gegenst.* Tab. 73.)

In the Northern Seas. Is a creature of great importance to the Finnish Islanders, the Kamschatkadales, and particularly to the Greenlanders and the Esquimaux of Labrador. The two latter people live on its flesh, clothe themselves, build their Summer huts, make their canoes, &c., of its skin. Its chase forms their principal business, and their success in this is at once their fortune and their glory.

2. *Monachus*. The Hooded Seal. *Ger.* die Mönchsrobbe. *Fr.* le Phoque a ventre blanc.—*P.* inauriculata, dentibus incisoriis utrinque 4; palmis indivisis, plantis exungiculatis. (*BUFFON, Supplem.* Vol. VI. Tab. 44.)

Principally in the Mediterranean Sea. Very docile. Remarkable for the incessant variation of its features.

3. *Ursina*. The Ursine Seal. *Ger.* der Seebär. *Fr.* l'Ours marin.—*P.* auriculata, collo lævi.

(*BUFFON, Supplem.* Vol. VI. Tab. 47.)

During Summer, in herds on the islands of the Kamschatkan Archipelago, but probably winters in the neighbouring and more southerly islands of the Pacific Ocean. Lives in polygamy, each male having from thirty to forty females, which he guards with much jealousy, and fiercely defends against his rivals †.

4. *Jubata*. The Sea-Lion. *Ger.* der Stellersche. See-Löwe. *Fr.* le Phoque à criniere.—*P.* auriculata, collo jubato.

* Thus, for instance, in 1784, on dissecting the eye of a Seal, I found a remarkable deposition through which the animal is enabled to elongate or shorten the axis of the organ at pleasure, and by that means to see equally well in two Media of very different density, viz. Water and Air.—See my *Manual of Comparative Anatomy*. § 274. Tab. 6.

† G. W. STELLER'S *Beschreibung von sondebaren Meerthieren*, Halle, 1753. 8vo. (from the *Nov. Comment. Petropolit.*)

(BUFFON, *Supplem.* Vol. VI. Tab. 48.)

In the whole of the Pacific Ocean. The largest species of this Genus. It has its name from the Lion-like mane of the male.

5. *Proboscidea*. (Cristata LINN.) The Sea Elephant. ANSON'S Sea-Lion. *Fr.* le Phoque a Trompe.—*P. naso proboscideo retractili.*

(PERON, *Voy. aux Terres Australes.* Tab. 32.)

On the Southern Islands of the Atlantic and Pacific Oceans. Is about 30 feet in length. The male alone has the remarkable proboscis-like nose.

45. *LUTRA*. *Palmae plantæque natatoriæ. Dentes primores utrinque 6, superiores distincti, inferiores conferti.*

2. *Vulgaris*. The Otter. *Ger.* die Fischotter. *Fr.* la Loutre *L. plantis nudis, cauda corpore dimidio brevior.*

(V. WILDUNGEN *Taschenbuch*, f. 1798.)

In the temperate parts of the Northern World. The most beautiful in Canada.

2. *Brasiliensis*. The American Otter. *Ger.* die Brasilische Flussotter. *Fr.* La Loutre d'Amerique.—*L. badia, macula alba submentali, cauda corpore dimidio brevior.*

(*Abbild. Nat. Hist. Gegenst.* Tab. 93.)

This Species, commonly confounded with the following one, lives in the rivers and lakes of the eastern and inner parts of South America.

3. *Marina*. The Sea Otter. *Ger.* die See Otter. *Fr.* la Loutre de mer.—*L. nigra, plantis pilosis, cauda corpore quadruplo brevior.*

(COOK'S *Voyage to the Northern Hemisphere*, Vol. II. Tab. 43.)

In particular on Kamschatka, and the opposite coasts of the north-west of America down to Nootka Sound, also, as far as Corea, and especially in the Yellow Sea. Its black and silver-grey skin is, with the Chinese, the most valuable of all peltry.

(C.) *Bruta*. Without teeth, or at least without front teeth.

48. *ORNITHORYNCHUS*. *Mandibulae rostratae (anatinæ) Dentes nulli **.

* For the organs which SIR E. HOME has described as the molar teeth, and which neither possess enamel or bony substance, fangs nor alveoli; the structure of which too, he has compared with that of the inner membrane of the gizzard in fowls, cannot, according to the scientific terminology of Anatomy and Natural History, be considered as actual teeth of a warm blooded quadruped.

1. *Paradoxus*. The Duck-billed animal. *Ger.* das Schnabelthier.

(*Abbild. Nat. Hist. Gegenst.* Tab. 41.)

This extraordinary creature is distinguished from all mammiferous animals yet known, by the unprecedented formation of its jaws, which resemble in the closest possible manner, the broad flat bill of a Duck, are covered in the same way with a soft membrane, plentifully supplied with nerves for the purpose of tasting, and also like it, serrated at the lateral edges. The feet are provided with webs, which in the front ones project beyond the claws, and can by that means be folded up or expanded like a fan. No appearances of teats have been hitherto detected in either sex. This wonderful animal lives near the lakes about Botany Bay, in the fifth part of the world, so rich in creatures of remarkable formation.

47. *TRICHECHUS*. *Pedes posteriores compedes coadunati.*

1. *Rosmarus*. The Walrus. *Ger.* das Wallross. *Fr.* le Morse.
—*T. dentibus laniariis superioribus exsertis.*

(*Abbild. Nat. Hist. Gegenst.* Tab. 15.)

On the floating ice about the North Pole. Feeds on sea-weed and shell-fish, which it detaches with its long tusks. The ancient Normans made their almost indestructable cables from its skin *.

2. *Manatus*. The Manati. *Ger.* die Seekuh. *Fr.* le Laman-tin.—*T. dentibus laniariis inclusis.*

(*SCHREBER.* Tab. 80.)

Found in the rivers and on the coasts of the warmer parts of the world, for instance in numbers in the Orinoco. It has probably given origin to many of the tales about Syrens and Mermaids †.

IX. CETACEA.

The mammiferous animals which were formerly so incorrectly classed among Fishes ‡.

48. *MONODON*. *Dens alteruter maxillæ superioris exsertus longissimus, rectus, spiralis.*

* See ONTHERE'S *Voyage* in J. SPELMANNI *Vita Aelfredi magni Anglor. Regis.* p. 205.

† The *Lapides Manati*, as they are improperly called, do not belong to this animal, but are commonly a part of the auditory passage and tympanum of the whale.

‡ See Prof. SCHNEIDER'S *Vermischte Abhandl. zur Aufklärung der Zoologie*, &c. *Berlin*, 1784, 8vo. p. 175-304. Also,

C. LACÉPÈDE *Histoire Naturelle des Cetacées*.—Paris. An 12. 4to.

1. *Narwhal*. The Narwhale. *Ger.* das See-Einhorn.*(Abbild. Nat. Hist. Gegenst. Tab. 44.)*

Principally in the north of the Atlantic Ocean. The young animal has originally two teeth (one in each bone of the upper jaw,) of unequal size; both are rarely found in the full grown animal. The tooth is occasionally as long as the body, *i.e.* 18 feet and upwards.

49. *BALÆNA*. *Dentes nulli. Laminæ loco superiorum corneæ.*

1. *Mysticetus*. The Black Whale. *Ger.* der Wallfisch. *Fr.* la Baleine.—*B. dorso impinni.**(Abbild. Nat. Hist. Gegenst. Tab. 94.)*

The largest of all known animals*, weighing upwards of 100,000lbs. It is found near the North Pole, in the southern parts of the Atlantic, and in the Pacific Ocean. Those that are taken at the present day are rarely longer than from 60 to 70 feet. The vast head forms full a third of the whole length of the animal. The skin is mostly black, or marbled with white, and shell-fish is often attached to it; it has a few scattered hairs, This monstrous animal furnishes at once food and clothing to the Kamschatkadale islanders, and the natives of the north-west of America. The Europeans, on the contrary, take the Whale (of which a large one may be worth 5000 rix-dollars,) for the sake of the oil and bones, of which there are 700 in the upper jaw, the middle ones at least 20 feet long.

2. *Rostrata*. The sharp-nosed Whale. *Ger.* der Finnfische.—*B. pectore sulcato, pinna dorsali obtusa.**(Abbild. Nat. Hist. Gegenst. Tab. 74.)*

The skin on the neck, breast, and fore part of the belly in this and other species of this Genus, is very regularly furrowed longitudinally †.

50. *PHYSETER*. *Dentes in maxilla inferiore.*

1. *Macrocephalus*. The White Whale. *Ger.* der Pottfisch. *Fr.* le Cachalot.—*B. dorso impinni, dentibus inflexis, apice acutiusculo.**(Abbild. Nat. Hist. Gegenst. Tab. 84.)*

* For the supposed *Kraken*—see the Article *Asterias caput Medusæ*.

† A fin-fish of this kind (by which name the Whale-fishers designate all the species of this Genus that have a dorsal fin, as *B. physalus*—*boops*, &c.,) which I had an unhopd for opportunity of seeing stranded in the fresh state, was 52 feet long, and had 64 such furrows on the breast, more than a thumb's breadth wide and deep.

Principally in the South Seas, and particularly on the coasts of Brazil and New South Wales : it reaches the size of the true Whale, has an enormous gullet, and can swallow Sharks six feet long. The upper jaw is very broad ; the lower, on the contrary, very narrow. It is taken principally for the sake of the spermaceti, which is found in the form of a milk white oil, partly in the body near the blubber, and in greater quantity in particular cavities on the head, particularly in front of the upper jaw. When exposed to the air, it hardens into a semi-transparent kind of tallow. The valuable and odoriferous ambergris is a fœcal induration, principally found in the large intestines of the Cachalot when in a state of disease.

51. DELPHINUS. Dentes in maxilla utraque.

1. *Phocæna*. (Tursio. PLIN.) The Porpoise. *Ger.* das Meer-schwein, der Braunfisch. *Fr.* le Marsouin.—D. corpore subconiformi, dorso lato pinnato, rostro subobtusum.

(SCHREBER. Tab. 342.)

Together with the next species, in the European Seas : it is also nine feet long, and very destructive to salmon.

2. *Delphis*. The Dolphin. *Ger.* der Delphin. Tümmeler. *Fr.* le Dauphin.—D. corpore oblongo subtereti, dorso pinnato, rostro attenuato, acuto.

(*Abbild. Nat. Hist. Gegenst.* Tab. 95.)

The true Dolphin of the ancients.

3. *Orca*. The Grampus. *Ger.* der Nordcaper, Speckhauer. *Fr.* l'Épaulard.—D. pinna dorsi altissima; dentibus subconicis, parum incurvis.

(SCHREBER. Tab. 240.)

Mostly in the Northern Seas, but also in the Mediterranean; is 20 feet in length.

SECT. V.

OF BIRDS.

§ 55. Mammifera present such considerable differences in their forms, their mode of life, &c., as to make it difficult to generalize on the subject, and consequently, to render it necessary to enter more particularly into their individual history. The case is otherwise with respect to Birds. Their forms, as well as their modes of life are, taken altogether, much more uniform, a circumstance by which we are enabled to treat more briefly of the particular history of individual Genera and Species.

§ 56. With regard to form, all Birds coincide in having *two feet, two wings, a bill, either partly or entirely horny, and a body covered with feathers*. They are distinguished by these four characters from all other animals, and constitute as it were an isolated class of beings, which does not pass into any other, and which cannot, therefore, be introduced without violence into the supposed chain or gradation of natural bodies. (§ 4.)

§ 57. Of these characters, one is peculiar to Birds, viz. feathers placed in regular order (in quincunx,) in the skin, passing through a considerable quantity of fat, and thrown off and again renewed at certain seasons of the year, generally in Autumn. Many, such as most water-fowl, the ptarmigan, &c., moult twice in the year, in Autumn and in Spring. In many Species, the young birds, particularly before the first moulting, have different marks or colours of the feathers, from those which the older ones present. In many instances too, there are considerable differences depending on the sex. The feathers differ from hair in this respect, that when once cut or otherwise injured, they never, as far as is known, are restored.

§ 58. The strongest feathers are in the pinions and tail: the former are called *Remiges*, the latter *Rectrices*. The pinion-feathers form, when the wing is expanded, as it were, broad fans, by which the bird is enabled to raise itself in the air and fly. Some few birds (*aves impennes*), as the Penguin, &c., have scarcely any pinion-feathers, and are therefore unfit for flight.

Some others also, as the Cassowary, Diver, &c., have not any tail-feathers.

§ 59. In their internal structure *, Birds are distinguished by the remarkable receptacles for air dispersed through their body, and of the utmost importance in assisting their flight. They are mostly connected with the lungs, sometimes, however, only with the throat, and can be filled or emptied at pleasure. To these receptacles belong, in particular, large but delicate membranous cells, situated partly in the abdomen, partly under the wings, and elsewhere beneath the skin, and which can be filled with air through the lungs. The cavities in some of the bones, as of the shoulder, and in many cases even of the head, contribute to the same objects, to which, also, the enormous bills of the Toucan and Rhinoceros bird are accessory.

§. 60. By these notable dispositions, Birds are adapted for flight, of which the rapidity, as well as the continuance are alike remarkable. A few only, as the Ostrich, the Cassowary, Penguin, and other *aves impennes*, are incapable of flying.

§. 61. The abode of Birds is nearly as various as that of mammifera. Most live in trees; others in water; very few wholly on the ground: and not a single bird under ground, as the Mole in the preceding, and other creatures in the two following Classes of animals. The form of the foot in birds, as in mammifera, is adapted to the differences of their abodes †.

§ 62. Many Birds change their residence at certain seasons; the greater number only in so far as that they remove a few leagues into neighbouring districts, and speedily return to their former situation: others, on the contrary, as Swallows, the Crane, the Stork, &c., make long journeys in Autumn over seas, and a considerable portion of the earth, and remain in warmer regions during Winter, until their return in the following Spring.

§ 63. There is not any Bird provided with teeth, but they either tear their food with the beak, or swallow it whole. In

* I have treated more fully of the peculiarities of the internal structure of Birds, in the *Specimen physiologiæ comparatæ inter animantia calidi sanguinis vivipara et ovipara*—published in the *Comment. Societ. Reg. Scient. Göttingen.*—Vol. IX. p. 108-128.

† The technical names of these different forms are explained in FORSTER's *Enchiridion*, p. 15.; in ILLIGER's *Terminology*, p. 187.; and in the third Part of BECHSTEIN's *Ornithologisches Taschenbuch*.

Birds that live on seeds, and swallow the grains unbroken, they do not pass at once into the stomach, but are previously softened in a *crop* (*ingluvies*, *prolobus*) abounding with glands, and thence are gradually propelled into the stomach. The latter is in these animals extremely muscular, and so powerful, that, according to the remarkable experiments of REAUMUR and others, it is able to break nuts and olive kernels, and to wear the impressions on pieces of money as smooth as paper. In addition, many birds swallow little pebbles, which also contribute to the division and subsequent digestion of their food *. Various carnivorous birds, as Falcons, Owls, the King-fisher, &c., are unable to digest the bones, hair, &c., of their prey, but vomit them up after each meal, in the form of a round ball †.

§ 64. Among the peculiarities of the organs of sense in birds, as compared with mammifera, are the want of an external cartilaginous ear, for the purpose of collecting sounds, a deficiency, however, which is compensated for, especially in nocturnal birds of prey, by the extremely regular circular disposition of the feathers in the situation of the ear, and in many, by the super-addition of a moveable valve on the external auditory passage.

Remark. Only a very few birds, viz. Ducks, and some similar species, appear to possess a real sense of taste; in them the organ is the soft covering of the bill, which is supplied with exceedingly large cutaneous nerves, and is very sensible in the living animal. Accordingly it is easy to remark the manner in which Ducks *probe*, as it were, the puddles in search of their food, where they cannot be guided by their sight or smell.

§ 65. The voice of Birds, particularly the small Singing birds, is varied and agreeable; but they cannot be so correctly said to sing as to whistle, for natural singing is an exclusive

* Physiologists have differed as to the object and use for which stones are thus swallowed. Many have even supposed that it proceeds from stupidity. According to my own investigations, it is an indispensable measure of assistance to digestion, by depriving the seeds swallowed of their vitality, without which they would not yield to the digestive powers.

† From a similar source arise the Star-shoots, as they are called, viz. the greyish-white, gelatinous lumps, commonly with the convoluted form of intestines, found in meadows, and consisting of half-digested viscera of frogs, which have been rejected by crows, marsh and water birds. See Dr. PERSOON, in VOIGT's *Neues Magazin*, Vol. I. Part 2. p. 56. et seq.

privilege of man. Besides the receptacles of air already mentioned, (§ 59.) their song is accomplished particularly by the disposition of the larynx, which in birds is not, as in mammifera and amphibia, placed wholly at the upper end of the wind-pipe, but, as it were, separated into two parts, one placed at each extremity. Parrots, Ravens, Starlings, Bullfinches, &c. have been taught to imitate the human voice, and to speak some words; Singing birds also, in captivity, readily adopt the song of others, learn tunes, and can even be made to sing in company, so that it has been possible actually to give a little concert by several Bullfinches. In general, however, the song of birds in the wild state appears to be formed by practice and imitation.

§ 66. Most birds pair in Spring; many, however, as the Cross-bill, at the coldest season of the year, after Christmas. Our domestic poultry are not confined to any particular time in this respect, but are always capable of breeding. Some birds remain in company only during the time of pairing; others, as the Dove and house Swallow, constantly; others again, as the domestic fowl, and of wild birds, the Ostrich, are polygamous.

§ 67. The female, when impregnated, is impelled by instinct to provide for the future, and to build a nest, to which perhaps, besides the Cuckoo, there are very few exceptions, such as the Goatsucker. Among polygamous birds, such as the various kinds of Poultry, the male has no share in this business; in those, on the contrary, which live together, as among the Singing birds in particular, he also brings materials for constructing the nest, and feeds his mate during her employment.

§ 68. The selection of the place in which each species forms its nest, corresponds with its wants and mode of life. Equal care is shewn by each in the choice of materials for the composition of the nest.

§ 69. The form of the nest is, in different instances, more or less artificial. Many birds, as Snipes, the Bustard, and Lapwing, make merely a dry layer of brushwood, straw, &c., on the surface of the ground; others make a soft but unartificial bed in the holes of walls, rocks, or trees, as the Woodpecker, Jay, Jackdaw, and Sparrow. Many, particularly among the Gallinæ, Doves, and Singing birds, give their nests the form of a hemisphere, or of a plate; others, as the Wren, the

shape of an oven; others again, as many Titmice, the Hawfinch, &c., that of a bag, and so forth*.

§ 70. When the formation of the nest is completed the mother lays her eggs, the number of which varies much in different species. Many Water-birds, for instance, lay each time but one egg; most Doves, two; Gulls, three; Ravens, four; Finches, five; Swallows, six to eight; Partridges and Quails, fourteen; and the domestic fowl, particularly when its eggs are taken away, fifty and more †. Many birds, often lay eggs without previous impregnation, which cannot produce young, and are called wind-eggs (*ova subventanea, cynosura, zephyria, hypenemia.*)

§ 71. The formation of the young animal, which in mammifera is carried on in the womb, in birds, on the contrary, is completed by the incubation of the egg after it has been deposited. The Cuckoo alone does not hatch its eggs, but leaves them to the Hedge-sparrow, or Water-wagtail, in whose nests it lays them. On the other hand, it is known that Capons, Dogs, and even Men have hatched eggs ‡. Chickens too, can be easily hatched by artificial means merely, from heated dung ||, the lamps of hatching machines, or ovens §. Birds are fatigued by long continued incubation; and it is only among those which live in pairs, as Doves, Swallows, &c., that the male takes any part in the business. The cocks of the Canary bird, Linnet, Goldfinch, &c., though they leave the hatching altogether to the females, supply them during its continuance with food, and in part from their own crop.

§ 72. During incubation, a remarkable process is going forwards, the chick being progressively formed in the egg, and

* AD. L. WIRSING *Sammlung von Nestern und Eyern verschiedner Vögel, beschrieben von FR. CHR. GÜNTHER, Nürnberg. 1772. folio.*

† In this case too, the laying of eggs appears to be a voluntary function, in which respect it differs remarkably from the totally involuntary parturition of mammifera.

‡ PLIN. L. 10. Cap. 55. "Livia Augusta, prima sua juvenia Tiberio Cæsare ex Nerone gravida, cum parere virilem sexum admodum cuperet, hoc usa est puellari augurio, ovum in sinu fovendo, atque cum deponendum haberet, nutrici per sinum tradendo, ne intermitteretur tepor."

|| ARISTOT. *Hist. Animal.* Lib. 6. Cap. 2. *L'Art de faire éclore des oiseaux domestiques, par M. DE REAUMUR.* Paris, 1741. 3 Vols. 12mo. *L'Abbé COPINEAU, Ornithotrophie artificielle.* Paris, 1780. 12mo.

§ See a precise description of this useful and cheap machine, together with interesting and instructive observations in HOLLMAN'S *Unterricht von Barometern und Thermometern.* Göttingen, 1785. 8vo. p. 206, 271. et seq.

brought daily nearer and nearer to maturity*. For this purpose, not only is the yolk specifically lighter than the white, but also that spot on its upper surface (the so called *cicatricula*), in which the future chick is placed, is lighter than the opposite side; so that in whatever position the egg is placed, the same part is always opposed to the belly of the incubating bird. The first trace of the chick is not perceptible until some time after the commencement of incubation; in the hen's egg, for instance, scarcely before the end of the first day; and at the end of the second, the remarkable spectacle of the first motions of the incomplete heart (*punctum saliens*) presents itself. At the end of the fifth day, the whole jelly-like creature may be seen to move. On the fourteenth, the feathers appear; at the commencement of the fifteenth the chick attempts to breathe; and on the nineteenth it is able to chirp.

Remark. The first form which the bird assumes in the egg differs more from that which it possesses after being hatched, than mammifera do in their first and subsequent form; we might say that the chick in the egg arrives at its more perfect form by a real metamorphosis, and this as well with respect to individual organs (the heart for example), as the whole form.

(*Abbild. Nat. Hist. Gegenst. Tab. 64.*)

§ 73. Among the many organs subservient to the remarkable economy of the chick during incubation, the two most important are the vascular membranes, which are most conspicuous and beautiful about the middle of the process. These are the *chorion*, which is then expanded under the shell; and the membrane of the yolk (*membrana valvulosa vitelli*), which communicates with the intestinal canal of the young animal. The first serves instead of lungs, for the phlogistic process already mentioned (§ 24.); and the second for nutrition by means of the yolk, which is gradually diluted by mixing with the white. (*Abbild. Nat. Hist. Gegenst. Tab. 34.*)

§ 74. Every Species of Bird has a fixed time of incubation, of different length in different cases, and capable of being accelerated or retarded according to the difference of climate, and the warmth or coldness of the weather. In the common

* For this progressive formation of the chick, and the organs in the egg belonging to its economy, see the 27th Section of my *Manual of Comparative Anatomy*.

fowl, the chick is usually able to creep out of the shell about the end of the twenty-first day.

§ 75. The young birds are fed for some time by the mother with great care; and among those which live in monogamy, also by the father, principally, in the granivorous birds, with the regurgitated contents of the crop, until such time as they are feathered, and capable of providing for themselves.

§ 76. Birds, in proportion to their size, and as compared with mammifera, attain a very advanced age: it is known that, even in captivity, Eagles and Parrots will live more than a hundred, Chaffinches and Goldfinches more than twenty-four years.

§ 77. Birds are extremely important creatures for the economy of Nature in general, although their immediate utility to mankind is infinitely less than that of mammifera. They destroy innumerable insects, and the thoughtless extirpation of some birds, supposed to be noxious, as Sparrows, Crows, &c., in many districts, has generally given rise to an infinitely more prejudicial multiplication of vermin. Other birds destroy larger animals, as Field Mice, Snakes, Frogs, Lizards, or consume carrion. Many extirpate weeds. On the other hand, they assist the increase and propagation of animals as well as plants. For instance, it is known that wild Ducks, in their emigrations, carry impregnated spawn into remote ponds, &c., and thus stock them with fish. Many birds swallow seeds, which are subsequently expelled whole, and thus extensively dispersed, as the Doves of Banda with the nutmeg. The excrement of Sea-birds manures bare cliffs and coasts, so as to render them capable of producing useful plants. Many species of Falcons may be taught for the chase, as well as the Cormorant for taking fish. Many birds, together with their eggs, fat, &c., serve for food; the entire skins of Sea-birds for the clothing of many Northern nations; the feathers for stuffing beds, for writing, for various and often costly ornaments, in which respect also they form an important article of trade among many savage people, particularly the islanders of the Pacific Ocean.

§ 78. The injury which birds give rise to, is almost wholly confined to the destruction of useful animals and plants. The Condor, the Vulture, and other birds of prey, kill Calves, Goats, Sheep, &c. The Osprey, and many Water-birds are as injurious to fish and their young, as the Hawk, Sparrow-hawk,

and Magpie, to common poultry. Sparrows, and many small Singing birds destroy corn, grapes, and fruit. And lastly, they assist in propagating weeds as well as serviceable plants. In this, as in the preceding class, no actually venomous animals are to be found.

§ 79. As the general form of birds is tolerably uniform, and certain parts of their body, as the bill and feet, which are connected with their mode of life, food, &c., influence their total habit very materially, most Ornithologists have grounded their classification on the differences of one or other of those parts: KLEINE, for instance, on the form of the toes; MÖHRING, on the coverings of the legs; BRISSON, on both, in combination with the nature of the bill, &c. LINNÆUS, in the plan of his System of Birds, also adopts several parts, in combination with, in general, a reference to the total habit; although in its practical application, he appears at times to have been forgetful; at least it is impossible to understand how Parrots, Humming-birds, and Crows, should be placed in the same Order; or why he should have placed Doves and the common Fowl in two separate ones, with other approximations and divisions of the same nature.

§ 80. I have, therefore, allowed myself to make some deviations from the Linnean system, and endeavoured to divide the whole class among the following nine Orders.

(A.) LAND BIRDS.

- I. ACCIPITRES. Birds of prey; with strong hooked beaks, mostly with short, strong, knotty feet, and large crooked sharp claws.
- II. LEVIROSTRES. With short feet, and very large, thick, but mostly hollow, and therefore light, bills. —Parrots, Toucans, &c.
- III. PICI. With short feet; moderately long and small bills, and the tongue sometimes worm-shaped, sometimes thread-like.—The Wry-neck, Woodpecker, Creeper, Humming-bird, &c.
- IV. CORACES. With short feet, and the bill moderately long, tolerably strong, and convex above.—Ravens, Crows, &c.
- V. PASSERES. The Singing birds, with Swallows, &c. The feet short, the bill more or less conical, pointed, and of various length and thickness.

- VI. GALLINÆ. Birds with short feet, the bill somewhat convex above, and having a fleshy membrane at the base.—I have placed the Doves in this Order, as they are far more closely connected with the Gallinæ than the Passeres, among which LINNÆUS had placed them.
- VII. STRUTHIONES. Large land birds, unsuited for flying.—The Ostrich, Cassowary, and Dodo.

(B.) WATER BIRDS.

- VIII. GRALLÆ. Birds found in marshes, with long feet; long, and almost cylindrical, bills, and generally a long neck.
- IX. ANSERES. Swimming birds with oar-like feet, a short bill covered with skin, generally serrated at the edge, and terminated at the extremity of the upper jaw by a little hook.

For the Natural History of Birds.

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For the Physiology of this Class of Animals. FR. TIEDEMANN'S *Zoologie*. 2r. u. 3r Bd. Heidelb. 1810-14. 8vo.

Of Land Birds in Seven Orders.

I. ACCIPITRES.

Almost all with short, strong feet, large sharp claws, and a strong hooked beak, which, for the most part, terminates above in two short cutting points, and is commonly covered at the root with a fleshy membrane. (*Cera*.) They live partly on carrion, partly on living animals, are monogamous, build their nests in elevated situations, and are coarse and disagreeable as food.

1. *Vultur*. Rostrum rectum, apice aduncum; plerisque caput et collum impenne. Lingua bifida.

1. *Gryphus*. The Condor.—V. caruncula verticali longitudine capitis.

(*De HUMBOLDT'S Recueil d'Observations de Zoologie*. Feb. 8-9.) Principally in the western parts of South America. It measures 12 feet across when the wings are expanded, and the

pinion feathers are full as thick as a finger in the quill. Its colour is blackish brown, with a white circle round the neck.—It builds its nest principally on rocky shores, flies at an extraordinary elevation, and lives by preying on cattle, and on the dead fish thrown up by the sea.

2. *Papa*. The King of the Vultures. *Ger.* der Geyerkönig, Sonnengeyer. *Fr.* le Roi des Vautours.—*V. naribus carunculatis, vertice colloque denudato.*

(*BUFFON. Oiseaux. Vol. I. Tab. 6.*)

In the West Indies and South America. Not larger than a turkey. With splendid yellow, red, and black colours, particularly about the head, and with a long fleshy fold over the beak. It can completely conceal its naked neck in the thick collar of feathers about the shoulders.

3. *Barbatus*. The Bearded Vulture. *Ger.* der Lämmergeyer, Bartgeyer. *Fr.* le Vautour des Agneaux.—*V. rostri dorso versus apicem gibboso, mento barbato.*

(*Abbild. Nat. Hist. Gegenst. Tab. 85.*)

In the Tyrolese and Swiss Alps; also in Siberia and Abyssinia. It is the largest of European birds, the wings, when expanded, measuring 10 feet. It is principally distinguished from other Vultures by its strong hairy beard, by its feathered neck, and especially by the convexity of the fore part of the upper jaw*.

4. *Pernopterus*. The common Vulture. *Ger.* der Aasgeyer. *Fr.* le petit Vautour.—*V. remigibus nigris, margine exteriore, præter extimas, canis.*

Particularly numerous in Palestine, Arabia, and Egypt. It destroys Mice, Lizards, &c., innumerable. The ancient Egyptians considered this, as well as other serviceable animals, sacred, and have frequently represented it in the hieroglyphics on their Obelisks, the coverings of their Mummies, &c.

2. *FALCO*. (*Span.* Acor.) Rostrum aduncum, basi cera instructum; caput pennis tectum; lingua bifida.

1. *Serpentarius*. The Secretary Bird. *Ger.* der Secretär. *Fr.* le Messager.—*F. cera alba, cruribus longissimis, crista cervicali pendula, rectricibus intermediis elongatis.*

(*Abbild. Nat. Hist. Gegenst. Tab. 55.*)

* Many modern Naturalists, for example *BUFFON*, *FORTIS*, together with *BOMARE*, *MOLINA*, and others, have considered this species identical with the Condor, but incorrectly.

At the Cape, and farther inland; also at the Philippines. It has long legs like wading birds (Grallæ*.)

2. *Melanaëtus*. The Black Eagle. *Ger.* der Schwarzbraune Adler. *Fr.* l'Aigle commun.—F. cera lutea, pedibusque semilanatis, corpore ferrugineo, nigricante, striis flavis.

(v. WILDUNGEN *Taschenbuch*, f. 1800.)

In Europe. Considerably smaller than the next species.

3. *Chrysaëtos*. The Golden Eagle. *Ger.* der Goldadler, Steinadler. *Fr.* le Grand Aigle.—F. cera lutea, pedibusque lanatis luteo-ferrugineis, corpore fusco ferrugineo vario, cauda nigra, basi cinereo undulata.

(BUFFON. Vol. I. Tab. 1.)

In the mountainous parts of Europe. Builds its nest on high cliffs, and supplies its young with the flesh of hares, &c.

4. *Ossifragus*. The Sea Eagle. *Ger.* der Seeadler, Fischadler. *Fr.* l'Orfraie.—F. cera lutea, pedibusque semilanatis, corpore ferrugineo, rectricibus latere interiore albis.

(v. WILDUNGEN *Taschenbuch*, f. 1801.)

On the coasts of Europe; also in North America, and some parts of the South Seas. About the size of the Golden Eagle. Lives almost exclusively on fish.

5. *Haliaëtus*. The Osprey. *Ger.* der Entenstösser. *Fr.* le Balbuzard.—F. cera pedibusque cæruleis, corpore supra fusco, subtus albo, capite albido.

(BUFFON. Vol. I. Tab. 2.)

More commonly found on the shores of rivers than on the sea coast. Is often confounded with the Sea Eagle.

6. *Milvus*. The Kite. *Ger.* die Weihe, der Gabelgeyer. *Fr.* le Milan.—F. cera flava, cauda forficata, corpore ferrugineo, capite albidior.

(FRISCH. Tab. 72.)

In almost the whole of the Old World.

7. *Gentilis*. The Gentil Falcon. *Ger.* der Edelfalke. *Fr.* le Faucon.—F. cera pedibusque flavis, corpore cinereo maculis fuscis, cauda fasciis quatuor nigricantibus.

(FRISCH. Tab. 74.)

In the mountainous parts of the North. It passes into nume-

* Hence many writers have classed it among the Grallæ. I have now, however, an excellent stuffed specimen in the Academical Museum before me, and saw the bird alive in London. I am convinced, as well from its form as its mode of life, that I have here assigned it the most suitable situation in the system.

rous varieties, some of which have often been taken for distinct Species. Together with many other closely connected Species of this Genus, it is trained to the chase of small mammifera and birds, viz., in the East of the Gazelle, and in Europe of the Heron.

8. *Palumbarius*. The Goshawk. *Ger.* der Habicht. Tabenfalke. l'Autour.—F. cera nigra, margine pedibusque flavis corpore fusco, reatricibus fasciis pallidis, superciliis albis.

(FRISCH. Tab. 81, 82.)

A native of nearly the same places with the preceding Species.

9. *Nisus*. The Sparrow-hawk. *Ger.* der Sperber. *Fr.* l'Epervier.—F. cera viridi, pedibus flavis, abdomine albo griseo undulato, cauda fasciis nigricantibus.

(FRISCH. Tab. 90, 91, 92.)

In Europe.

3. *Strix*. Owl. *Ger.* Eule. Rostrum breve, aduncum, nudum absque cera; nares barbatae; caput grande; lingua bifida; pedes digito versatili; remiges aliquot serratae.

1. *Bubo*. The great horned Owl. *Ger.* der Uhu. die Ohreule. *Fr.* le Grand Duc.—S. auribus pennatis, iridibus croceis, corpore rufo.

(v. WILDUNGEN *Taschenbuch*, f. 1795.)

The largest of the Genus. Found in the temperate parts of Europe and the west of Asia*.

2. *Nyctea*. The Snowy Owl. *Ger.* die Schnee-Eule. Harfang.—S. capite laevi, corpore albido, maculis lunatis distantibus fuscis.

(*Abbild. Nat. Hist. Gegenst.* Tab. 75.)

In the Northern parts of the World. A splendid looking creature.

3. *Flammea*. The Barn Owl. *Ger.* die Schliereule, Kircheneule. *Fr.* l'Effraie.—S. corpore luteo punctis albis, subtus albido punctis nigricantibus.

(v. WILDUNGEN *Taschenbuch*, f. 1805.)

In the temperate regions of the Old and New World. Of exceedingly soft and beautiful plumage.

4. *Passerina*. The Little Owl. *Ger.* das Kautzchen. *Fr.* la

* LINNEUS, with many other Naturalists and Antiquaries, have supposed that this was the bird of Minerva. I have shewn, however, from the ancient works of Grecian art, that it was not this, but rather some smooth-headed species, probably the little Owl (*S. Passerina*.) See my *Specimen Historiæ Naturalis antiquæ artis operibus illustratæ*. p. 20. seq.

Chevêche.—*S. capite lævi, remigibus maculis albis quinque ordinum.*

(FRISCH. Tab. 100.)

In Europe and North America.

4. *LANIUS*. Rostrum rectiusculum, dente utrinque versus apicem, basi nudum; lingua lacera.

1. *Excubitor*. The Great Shrike. *Ger.* der Würger Bergälster. *Fr.* la Pie-grieche grise.—*L. cauda cuneiformi, lateribus alba, dorso cano, alis nigris macula alba.*

(FRISCH. Tab. 50.)

In Europe and North America. This, as well as the next species, imitates the voice of other birds most closely.

2. *Collurio*. The red-backed Shrike. *Ger.* der Neuntödter. *Fr.* l'Ecorcheur.—*E. cauda subcuneiformi, dorso griseo, rectricibus quatuor intermediis unicoloribus, rostro plumbeo.*

(FRISCH. Tab. 60.)

In Europe. Lives principally on insects, especially Beetles, Grasshoppers, &c., of which it makes a provision, by transfixing them on the spines of the Black-thorn.

II. LEVIROSTRES.

The Birds of this Order are almost exclusively confined to the warmer regions of the earth, and are recognizable by the bill, which is generally very large and thick, but light in comparison, and of which mention has been made above, (§ 59.) in speaking of the receptacles for air.

5. *PSITTACUS*. Parrot. *Ger.* Papagey. *Fr.* Parroquet. —Mandibula superiora dunca, cera instructa, lingua carnosa, integra. Pedes scansorii *.

It is remarkable that many individual Species of this extensive Genus, which Ornithologists have therefore divided into numerous families, are found only in districts of very limited extent. In the Philippines, for instance, many of them are confined to particular islands, and never met with on others lying in their immediate vicinity †. Parrots, in general, have striking peculiarities in their manners. Thus, they have the power

* *Histoire Naturelle des Perroquets. par F. LEVAILLANT. Paris, 1801, et seq. Gr. folio.*

† One cause, at least of this fact, is to be found in the wings of Parrots, which are short, and unfitted for long flights.—TRANSLATOR.

of using their feet almost like hands, as for carrying food to their mouths, scratching behind the ears, &c. When they walk on the ground, they tread not merely on the claws, like other birds, but on the whole of the foot. Their hook-shaped upper mandible is articulated, very moveable, and serves the purpose of a third foot in climbing. Both sexes readily learn to pronounce words, and they have been even taught to sing, though very seldom.

1. *Macao*. The Scarlet Maccaw. *Ger.* der Aras.—*P. macrourus ruber, remigibus supra cæruleis, subtus rufus, genis nudis rugosis.*

(EDWARDS' *Birds*. Tab. 158.)

In South America.

2. *Alexandri*. The Alexandrine Parrakeet.—*P. macrourus viridis, collari pectoreque rubro, gula nigra.*

(EDWARDS. Tab. 292.)

3. *Cristatus*. The Great White Cockatoo. *Ger.* der Cacadu. *Fr.* le Cacatoe.—*P. brachyurus, crista plicatili flava.*

(FRISCH. Tab. 50.)

In the East Indies, particularly the Malacca Islands.

4. *Erithacus*. The Grey Parrot. *Jaco.* *Ger.* der Aschgrau Papagey. *Fr.* le Perroquet cendré.—*P. brachyurus canus, temporibus nudis albis, cauda coccinea.*

(FRISCH. Tab. 51.)

From Guinea, Congo and Angola.

5. *Ochrocephalus*. The Yellow-headed Amazon.—*P. viridis, vertice flavo, tectricibus alarum puniceis, remigibus ex viridi, nigro, violaceo et rubro variis, rectricibus duabus extimis basi intus rubris.*

(DAUBENTON. Pl. 312.)

In the West Indies, &c.

6. *Pullarius*. The Guinea Parrot. *Fr.* l'Inseparable.—*P. brachyurus viridis, fronte rubra, cauda fulva fascia nigra, orbitis cinereis.*

(FRISCH. Tab. 54. fig. 1.)

In Guinea and the East Indies. Not much larger than a Bullfinch. It has its French name from its having been said, but untruly, that they must always be kept in pairs, a single one not surviving the loss of its mate.

6. *RAMPHASTOS*. Toucan. *Ger.* Pfefferfras.—Rostrum maximum, inane, extrorsum serratum, apice incurvatum. Pedes scansorii plerisque.

The enormous bill by which the numerous Species of this singular Genus of South American birds are distinguished, is extremely light, and of a soft horny substance. Their tongue is half a span long, like whalebone, at the root scarcely a line broad, and is serrated at the sides from the root forwards.—The plumage varies exceedingly, according to the differences of sex, age, &c.

1. *Tucanus*. R. nigricans, rostro flavescente versus basin fascia nigra, fascia abdominali flava.

7. *BUCEROS*. (*Hydrocorax*.) Rostrum maximum, inane, ad basin versus frontem recurvatum ; pedes gressorii.

All the Species of this Genus, equally extraordinary in its form, are natives of the East Indies and New Holland.

1. *Rhinoceros*. The Rhinoceros Bird. *Ger.* der Nashornvogel. *Fr.* le Calao.—B. processu rostri frontali recurvato.

(*Abbild. Nat. Hist. Gegenst.* Tab. 24.)

III. PICI.

The birds of this Order have short feet, and commonly a straight, but not thick bill, of moderate length.

8. *PICUS*. Rostrum polyedrum, apice cuneato ; lingua teres lumbriciformis, longissima, mucronata, apice retrosum aculeato : pedes scansorii.

The Peckers have a very remarkable structure of the tongue, the Os Hyoides extending into two long cartilages, which are placed immediately under the skin, running from behind forwards over the skull, and terminating at the forehead near the root of the bill. These cartilages are like springs, by means of which the bird can more readily protrude its worm-shaped tongue, and transfix insects with its horny point.

1. *Martius*. The Great Black Wood-pecker. *Ger.* der Schwartzspecht. *Fr.* le Pic Noir.—P. niger, vertice coccineo.

(*FRISCH.* Tab. 34. fig. 1.)

Together with the following Species, in the temperate parts of Europe and the North of Asia.

2. *Viridis*. The Green Wood-pecker. *Ger.* der Grünspecht. *Fr.* le Pic Verd.—P. viridis, vertice coccineo.

(*FRISCH.* Tab. 35.)

3. *Major*. The Greater Spotted Wood-pecker. *Ger.* der Grosse Buntspecht. *Fr.* l'Epèche.—P. albo nigroque varius, occipite rubro.

(FRISCH. Tab. 36.)

4. *Minor*. The Lesser Spotted Wood-pecker. *Ger.* der Kleine Buntspecht. *Fr.* Le petit Epèiche.—P. albo nigroque varius, vertice rubro.

(FRISCH. Tab. 37.)

9. *JYNX*. Rostrum teretiusculum, acuminatum; lingua lumbriciformis, longissima, mucronata; pedes cansorii.

1. *Torquilla*. The Wryneck. *Ger.* der Drehhals, Wendehals. *Fr.* le Torcol.—I. cauda explanata, fasciis fuscis quatuor.

(FRISCH. Tab. 38.)

It has its name from the uncommon mobility of its neck, and inhabits nearly the same regions as the Peckers.

10. *SITTA*. Rostrum subulatum, teretiusculum, apice compresso, mandibula superiore paulo longiore; pedes ambulatorii.

1. *Europæa*. The Nuthatch. *Ger.* der Blauspecht. *Fr.* la Sittelle.—S. rectricibus nigris, lateralibus quatuor infra apicem albis.

(FRISCH. Tab. 39.)

In the Northern parts of Europe, Asia, and America.

11. *TODUS*. Rostrum subulatum, depressiusculum, obtusum, rectum, basi setis patulis; pedes gressorii.

1. *Viridis*. The Green Tody. *Fr.* Le Todier.—T. viridis, pectore rubro.

In the middle regions of America.

2. *Paradisæus*. T. capite cristato nigro, corpore albo, cauda cuneata, rectricibus intermedijs longissimus.

In the South of Africa, Madagascar, &c.

12. *ALCEDO*. Rostrum trigonum, crassum, rectum, longum; pedes breves, gressorii.

1. *Ispida*. The King-fisher. *Ger.* der Eisvogel. *Fr.* le Martin-pecheur.—A. supra cyanea, fascia temporali flava, cauda brevi.

(FRISCH. Tab. 223.)

In almost the whole of the Old World. It lives on fish, the bones of which it rejects. (§ 63.) The facility with which it dries after death, without becoming putrid, is not peculiar to this bird, as PARACELsus and many others have supposed, but is observed in similar circumstances of the Cross-bill, the Canary, and others.

13. *MEROPS*. Rostrum curvatum, compressum, carinatum ; pedes gressorii.

1. *Apiaster*. The Common Bee-eater. *Ger.* der Immenwolf. *Fr.* le Guèpier.—M. dorso ferrugineo, abdomine caudaque viridi cærulescente, gula lutea, fascia temporali nigra.

(*V. WILDUNGEN Taschenbuch*, f. 1808.)

In the South of Europe and the temperate parts of Asia. It lives on insects.

14. *UPUPA*. Rostrum arcuatum, convexum, subcompressum, obtusiusculum ; pedes ambulatorii.

1. *Epops*. The Common Hoopoe. *Ger.* der Wiedehopf. *Fr.* la Huppe.—U. crista variegata.

(*FRISCH*. Tab. 43.)

In Europe and the East Indies. It lives on earth-worms and various insects. It builds its nest in hollow trees, and frequently, as *ARISTOTLE* had already remarked, on a layer of human excrement*.

15. *CERTHIA*. Rostrum arcuatum, tenue, subtrigonum, acutum ; pedes ambulatorii.

1. *Familiaris*. The Common Creeper. *Ger.* die Baumklette. *Fr.* le Grimpereau.—C. grisea, subtus alba, remigibus fuscis ; rectricibus decem.

(*FRISCH*. Tab. 39. Fig. 1.)

In Europe. It climbs like the Wood-pecker on the trunks of trees in search of Insects and their Larvæ, &c.

2. *Muraria*. The Wall Creeper. *Ger.* der Mauerspecht. *Fr.* le Grimpereau de Muraille.—C. cinerea, rectricibus roseis, remigibus rectricibusque fuscis, maculis alarum fulvis niveisque.

(*Abbild. Nat. Hist. Gegenst.* Tab. 76.)

This exceedingly beautiful bird is about the size of a Sparrow, and lives in solitude in the warmer parts of Europe. It is very uncommon in Germany. It builds in old walls, steeples, &c.

3. *Coccinea*. (*Vestiaria*.) The Hook-billed Red Creeper.—C. coccinea, rectricibus remigibusque nigris.

(*Abbild. Nat. Hist. Gegenst.* Tab. 16.)

In the Sandwich Islands, the ingenious natives of which manufacture various articles of ornament and dress, as helmets, and even entire mantles with its carmine-red feathers.

4. *Sannio*. The Mocking Creeper.—C. olivacea, vertice subviolaceo, remigibus caudaque subfurcata fuscis.

* *NOZEMANN* et *CHR. SEPP* *Nederlandsche Vogeln.* p. 129. seq.

(*Abbild. Nat. Hist. Gegenst. Tab. 8.*)

From New Zealand.

16. *TROCHILUS**. Humming Bird. *Fr.* Oiseau-mouche. Rostrum subulato-filiforme longum. Mandibula inferiore tubulata, superiore vaginante inferiorem. Lingua filis duobus coalitis tubulosa; pedes ambulatorii, brevissimi.

As far as is at present known, the whole Genus is confined to America; not merely, however, to the warmer parts, but northwards as far as Nootka Sound, and southwards to the western coast of Patagonia.

(A.) *CURVIROSTRES*. (True Humming Birds.)

1. *Pella*. The Topaz-throated Humming Bird. *Fr.* Le Colibri-topase.—*T. ruber*, rectricibus intermediis longissimis, capite fusco, gula aurata uropygioque viridi.

(EDWARDS. Tab. 32.)

In Guiana. Full six inches in length.

(B.) *RECTIROSTRES*.

2. *Minimus*. The Least Humming Bird.—*T. corpore viridi nitente, subtus albedo; rectricibus lateralibus margine exteriori albis.*

(EDWARDS. Tab. 105.)

The smallest bird known, which, when dried, weighs only about 30 grains. Its nest is of cotton, and about the size of a walnut; its two eggs about as big as peas.

3. *Mosquitus*. The Ruby-headed Humming Bird. *Ger.* der Juwelen-Colibri. *Fr.* le Rubis-topase.—*T. viridescens vertice purpureo aurato, gutture auroreo rutilo.*

(SEBA. *Thes.* Tab. 37. fig. 1.)

The forehead and vertex of the male shine like ruby-red fire, and the throat like burnished gold.

IV. CORACES.

The Birds of this Order have short feet with a strong bill, convex on the upper part and of moderate size. They live partly on corn and other seeds, partly on insects, and on carrion: their flesh is for the most part wild tasted and unsavory.

17. *Buphagar*. Rostrum rectum, subquadrangulare; mandibulis gibbis, integris, extrorsum gibbosioribus. Pedes ambulatorii.

* *Histoire Naturelle des Colibris et des Oiseaux-Mouches*, par J. B. AUDEBERT. PARIS, 1800. seq. fol.

1. *Africana*. The Ox-pecker. *Fr.* le Pic-bœuf.

(LATHAM. Vol. I. P. 1. Tab. 12.)

In Senegambia, &c.

18. CROTOPHAGA. Rostrum compressum, semiovatum, arcuatum, dorsato-carinatum. Mandibula superiore margine utrinque angulata. Nares perviæ.

1. *Ani*. The Razor-billed Blackbird. *Ger.* der Madenfresser. *Fr.* le Bout de Petun.—C. pedibus scansoriis.

(LATHAM. L. c. Tab. 13.)

In the West Indies. Lives in a social state, several females keeping in company, building a nest, and hatching in common.

19. CORVUS. Rostrum convexum, cultratum, nares mystace tectæ; pedes ambulatorii.

1. *Corax*. The Raven. *Ger.* der Kolk-Rabe. *Fr.* le Corbeau.—C. corpore atronitente, rostri apice subincurvo, cauda semirhombea.

(FRISCH. Tab. 63.)

Together with the next species, inhabits almost the whole of both parts of the world. Its smell is exceedingly acute. It preys on fish, crabs, young ducks, and even levrets; it also carries other things not eatable to its nest.

2. *Corone*. The Carrion-Crow. *Ger.* die Raben-Krähe. *Fr.* la Corneille.—C. atro-cærulescens totus, cauda rotundata: rectricibus acutis.

(BUFFON. Vol. III. Tab. 3.)

3. *Frugilegus*. The Rook. *Ger.* de Saatkrahe. *Fr.* le Freux,—C. ater, fronte cinerascens, cauda subrotunda.

(FRISCH. Tab. 64.)

In all the temperate parts of Europe. The degree of injury which it does to corn is compensated by its much more considerable destruction of field-mice, grubs, and caterpillars.

4. *Cornix*. The Hooded-Crow. Royston-Crow. *Ger.* die Nebelkrähe. *Fr.* la Corneille mantelée.—C. cinerascens, capite, jugulo, alis, caudaque nigris.

(FRISCH. Tab. 65.)

In the milder regions of the Old World. In some situations it remains throughout the year; in others, it only appears during the Winter, without its being well understood whither it withdraws in Spring. It is useful by destroying vast quantities of vermin, but is also very injurious to the maize plantations.

5. *Monedula*. The Jackdaw. *Ger.* die Dohle. *Fr.* le Choucas.—C. fuscus, occipite incano, fronte, alis, caudaque nigris.

(FRISCH. Tab. 67.)

In the North-west of Europe.

6. *Glandarius*. The Jay. *Ger.* der Holzheher. *Fr.* le Geai.—*C. tectricibus alarum cæruleis, lineis transversis albis nigrisque, corpore ferrugineo variegato.*

(FRISCH. Tab. 55.)

In the temperate parts of Europe.

7. *Caryocatactes*. The Nut-cracking Crow. *Ger.* der Nussheher. *Fr.* le Casse-noix.—*C. fuscus alboque punctatus, alis caudaque nigris: rectricibus apice albis; intermediis apice detritis.*

(v. WILDUNGEN *Taschenbuch*, f. 1805.)

In the Northern parts of the World.

8. *Pica*. The Magpie. *Ger.* die Aelster. *Fr.* la Pie.—*C. albo nigroque varius, cauda cuneiformi.*

(FRISCH. Tab. 58.)

In Europe and North America. Injurious to young poultry, and to corn, but also destroying abundance of vermin.

20. *CORACIAS*. Rostrum cultratum, apice incurvato, basi pennis denudatum: pedes breves ambulatorii.

1. *Garrula*. The Roller. *Ger.* die Mandelkrähe. *Fr.* le Rollier.—*C. cærulea, dorso rubro, remigibus nigris.*

(v. WILDUNGEN *Taschenbuch*, f. 1807.)

In the temperate parts of Europe, and in North Africa. Is found in numbers in Autumn, when the corn is placed in sheaves.

21. *GRACULA*. Rostrum convexo-cultratum, basi nudiusculum. Lingua integra, acutiuscula, carnosula. Pedes ambulatorii.

1. *Religiosa*. The Minor Grakle. *Fr.* le Mainate.—*G. nigro-violacea, macula alarum alba, fascia occipitis nuda, flava.*

(BUFFON. Vol. III. Tab. 25.)

In the East Indies. Has a beautiful voice, and readily learns to speak.

2. *Quiscula*. The Shining Grakle. *Ger.* der Maisdieb.—*G. nigro-violacea, cauda rotundata.*

(CATESBY. Vol. I. Tab. 12.)

In North America.

22. *PARADISEA* *. (*Manucodiatta*.) Rostrum basi plumis

* *Histoire Naturelle des Grimpereaux sucriers, des Promerops, et des Oiseaux de Paradis, par L. P. VIELLOT, J. P. AUDEBERT, et C. SAUVAGES.* Paris, 1801. seq. folio.

Histoire Naturelle des Oiseaux de Paradis, des Rolliers et des Prome-

tomentosis tectum. Pennæ hypochondriorum longiores. Rectrices duæ superiores singulares denudatæ.

The many Species of this Genus are confined to very narrow limits, being natives of New Guinea only, and emigrating as birds of passage from thence to the Moluccas, and other islands in the vicinity. These birds are worn as ornaments in India, on account of their beautiful plumage, and when sold for this purpose, the Papous still cut off the feet, which led our credulous forefathers to suppose them really wanting*.

1. *Apoda*. The Great Bird of Paradise. *Fr.* l'Emeraude.—*P.* brunnea pennis hypochondriis luteis corpore longioribus, rectricibus duabus intermediis longis setaceis.

(EDWARDS. Tab. 110.)

2. *Alba*. The White Bird of Paradise. *Fr.* le Manucode à 12 filets.—*P.* antérieur nigra violacea; postérieur, alba, humeribus viride virgatis, rectricibus duodecim nigris.

(*Abbild. Nat. Hist. Gegenst.* Tab. 96.)

One of the most beautiful, and at the same time most uncommon Species of the Genus: in the body about the size of a Thrush.

23. *TROGON*. Rostrum capite brevius, cultratum, aduncum, margine mandibularum serratum. Pedes scansorii.

1. *Viridis*.—*T.* Viridi aureus, subtus luteus, gula nigra.

(EDWARDS. Tab. 331.)

In Guiana.

24. *Bucco*. (*Barbet*.) Rostrum cultratum, lateraliter compressum, apice utrinque emarginato, incurvato; rictu infra oculos protenso.

1. *Atroflavus*.—*B.* niger, jugulo, pectore et lineis supra et infraorbitalibus luteis, abdomine griseo.

(*Abbild. Nat. Hist. Gegenst.* Tab. 65.)

In Sierra Leone.

25. *Cuculus*. Rostrum teretiusculum. Nares marigine prominulæ. Pedes scansorii.

1. *Canorus*. The Cuckoo. *Ger.* der Kukuk. *Fr.* le Coucou.—*C.* cauda rotundata nigricante albo-punctata.

(FRISCH. Tab. 40.)

rops, suivie de celle des Toucans et des Barbus, par F. LE VAILLANT. Paris, 1801. folio.

* J. R. FOSTER on *Paradise Birds and the Phoenix, in the Indian Zoology*. 3d Edition. Halle, 1795. folio. p. 26. seq.

In the Northern parts of the Old World, where, however, it is visible only in the Spring and Summer. It does not itself hatch the six eggs which it lays from time to time in the Spring, but places them singly in the nest of the Hedge-sparrow, Water-wagtail, &c.*; the office of incubation being thus transferred to the latter. It is remarkable that its eggs, though much larger than those of the birds in question, do not stand in need of a longer period of incubation. The young Cuckoo grows rapidly, and soon expels the young brood of the Sparrow, &c., from their own nest. The Winter retreat of this bird has not yet been satisfactorily ascertained.

2. *Indicator*. The Honey Cuckoo.—*C. cauda cuneiformi fusco et albedo maculata, alis fuscis maculis flavis, pedibus nigris*.

(J. F. MILLER. *Fasc.* 4. *Tab.* 24.)

In the South of Africa, from the Cape northwards. It has its name from the dexterity with which, like the Honey-Bear, (*U. mellivorus*.) it obtains its favourite food from the nests of the wild Bees.

3. *Persa*. The Turaco.—*C. capite cristato, corpore viridicærulescente, remigibus sanguineis, cauda æquali*.

(BUFFON. *Vol.* VI. *Tab.* 15.)

In South Africa.

36. *ORIOLUS*. Rostrum conicum, convexum, acutissimum, rectum; mandibula superiore paulo longiore, obsolete emarginata; pedes ambulatorii.

1. *Galbula*. The Golden Oriole. *Ger.* die Gold-drossel. *Fr.* le Lorient d'Europe.—*O. Luteus, pedibus nigris, rectricibus exterioribus postice flavis*.

(FRISCH. *Tab.* 31.)

Here and there in the Old World. Lives in a state of bigamy. The male is gold-yellow and black, the female olive-green. It makes a very artificial, strong, and bowl-shaped nest, fastened between two branches.

2. *Phæniceus*. The Red-winged Oriole. *Ger.* der Maisdieb. *Fr.* le Lorient noir.—*O. niger, alarum rectricibus coccineis*.

(CATESBY. *Vol.* I. *Tab.* 13.)

In the temperate parts of North America. It commonly keeps in company with the *Gracula quiscula*.

* Or even thrusts them in with its bill. See WEIDMANN'S *Feierabende*. B. 1. S. 67. 1815.

3. *Jupujuba*. (*Persicus*, LINN.)—*O. niger*, dorso postico maculae tectricum alarum basique rectricum luteis.

(BRISSEAU. Vol. II. Tab. 9. fig. 1.)

In Brazil, &c. This, like the preceding, and many other Species of this Genus, constructs a long bag-shaped nest of reeds and rushes *, many hundreds of which are often seen hanging on a single tree.

V. PASSERES.

Small Birds, with short slender feet, and conical sharp-pointed bills, of various size and form. They are monogamous, live on insects and the seeds of plants, have delicate, well tasted flesh, and for the most part sing.

27. *ALAUDA*. Rostrum cylindrico-subulatum, rectum, mandibulis æqualibus, basi deorsum dehiscentibus. Unguis posticus rector digito longior.

1. *Arvensis*. The Sky-lark. *Ger.* die Hemmelslerche. *Fr.* l'Alouette.—*A. rectricibus extimis duabus extrorsum longitudinaliter albis; intermediis inferiore latere ferrugineis.*

(FRISCH. Tab. 15. fig. 1.)

In almost the whole of the Old World. It makes its nest on the ground like the Ostrich, Hen, and other birds, thence called *aves pulveratrices*.

2. *Cristata*. The Crested Lark. *Ger.* die Haubenlerche. *Fr.* le Cochevis.—*A. rectricibus nigris: extimis duabus margine exteriori albis, capite cristato.*

(FRISCH. Tab. 15. fig. 2.)

In Germany, and the neighbouring countries.

28. *STURNUS*. Rostrum subulatum, angulato-depressum, obtusiusculum: mandibula superiore integerrima, marginibus patentiusculis.

1. *Vulgaris*. The Starling. *Ger.* der Staar. *Fr.* l'Etourneau.—*S. rostro flavescente, corpore nigro punctis sagittatis albis.*

(FRISCH. Tab. 217.)

In most parts of the Old World. Of great utility, by destroying innumerable noxious insects.

29. *TURDUS*. Rostrum tereticultratum: mandibula superiore apice deflexo, emarginato.

1. *Viscivorus*. The Missel Bird. *Ger.* die Schnarre. *Fr.* la

* Particularly of the *Tillandia usneoides*, which has almost the appearance of horse hair.

Draine.—*T. dorso fusco, collo maculis albis, rostro flavescente.*

(FRISCH. Tab. 15.)

In different spots of the Old World. Lives on the berries of the Misteltoe, which it is the principal means of propagating.

2. *Pilaris*. The Fieldfare. *Ger.* der Krammetsvogel. *Fr.* la Litorne.—*T. rectricibus nigris; extimis margine interiore apice albicantibus, capite uropygioque cano.*

(FRISCH. Tab. 26.)

In the North of Europe, but emigrates into the South. Lives principally on the berries of the Juniper.

3. *Iliacus*. The Redwing. *Ger.* Weindrossel. *Fr.* le Mauvis.
—*T. alis subtus ferrugineis, superciliis flavescens.*

(FRISCH. Tab. 28.)

In the North of Europe. It smooths its nest with clay and rotten wood; and as the latter shines in the dark, it is possible that a mistake may have given rise to the idea of the ancients, of an "*Avis hercynica noctu lucens.*"

4. *Musicus*. The Thrush. *Ger.* die Sangdrossel. *Fr.* la Grive.
—*T. remigibus basi interiore ferrugineis.*

(FRISCH. Tab. 27.)

Extends more Southward than the preceding Species. A whitish grey variety is occasionally met with.

5. *Polyglottus*. The Mocking-bird.—*T. fusco-cinereus, subtus albidus, maculis verticis, alarum et caudæ candidis.*

(CATESBY. Vol. I. Tab. 27.)

In Louisiana, Carolina, Jamaica, &c. It imitates the voice of other birds easily and perfectly.

5. *Roseus*. The Rose-coloured Thrush.—*T. subincarnatus, capite, alis caudaque nigris, occipite cristato.*

(EDWARDS. Tab. 20.)

In the central parts of Europe and Asia. It destroys numbers of locusts.

7. *Merula*. The Blackbird. *Ger.* die Amsel. *Fr.* le Merle.—*T. ater, rostro palpebrisque flavis.*

(FRISCH. Tab. 29.)

In the temperate parts of Europe. Lives solitary, feeds on the Juniper berries, and has a very perfect memory.

30. *AMPELIS*. Rostrum rectum, convexum; mandibula superiore longiore, subincurvata, utrinque emarginata.

1. *Garrulus*. The Bohemian Chatterer. *Ger.* der Seidensch-

wanz. *Fr.* le Jaseur de Bohême.—A. occipite cristato : remigum secundariorum apice coccineo lanceolato.

(FRISCH. Tab. 32.)

In the North of Europe, but frequently come in numbers to Germany, particularly the Hartz, about Autumn.

31. *LOXIA*. Rostrum conico-gibbum, frontis basi rotundatum ; mandibula inferior margine laterali inflexa.

1. *Curvirostris*. The Cross-bill. *Ger.* der Kreutzschnabel. *Fr.* le Bec Croisé.—L. rostro forficato.

(FRISCH. Tab. 11. fig. 3, 4.)

In the Pine forests of the Northern parts of the World. It breeds in the depth of Winter, at the end of January.

2. *Coccothraustes*. The Hawfinch. *Ger.* der Kernbeisser. *Fr.* le Gros-bec.—L. linea alarum alba, remigibus mediis apice rhombeis, rectricibus latere basis tenuiore nigris.

(FRISCH. Tab. 4. fig. 2, 3.)

In various districts of Europe.

3. *Pyrrhula*. The Bullfinch. *Ger.* der Dompfaff. *Fr.* le Bouvreuil.—L. artubus nigris, rectricibus caudæ remigumque posticarum albis.

(FRISCH. Tab. 2. fig. 1, 2.)

In the North of the Old World. Both sexes readily learn to whistle tunes, to sing in parts, and even to pronounce words.

4. *Gregaria*.—L. ex griseo flavescens, fronte olivacea, nucha, humeris, alis et cauda fuscis.

(PATERSON'S *Journeys*, p. 133.)

At the Cape, where many hundreds together build their nests on a single tree, and cover the singular edifice with a common overhanging roof.

5. *Pensilis*. The Pensile Loxia.—L. viridis, capite et gutture flavis, fascia oculari viridi, abdomine griseo, rostro, pedibus, cauda remigibusque nigris.

(SONNERAT. *Voy. aux Indes*. T. 2. Tab. 12.)

Likewise at the Cape, and also at Madagascar. It builds a remarkable nest in the vicinity of water, in shape almost like a retort, with a depending neck for ingress and egress, and so disposed that the aperture is close to the surface of the water.

6. *Philippina*.—L. fusca, subtus albido-flavicans, vertice pectoreque luteis, gula fusca.

(DAUBENTON, *Planches*. Tab. 135. fig. 2.)

In the East Indies: very docile, and in the Indian Peninsula,

is often taught to perform many little offices. This species too builds a very ingenious hanging nest among reeds, &c.

7. *Cardinalis*. The Red Bird. Cardinal Bird. *Ger.* die Virginsche Nachtigall.—*L. cristata rubra, capistro nigro, rostro pedibusque sanguineis.*

(FRISCH. Tab. 4. fig. 1.)

In North America, and is brought in great numbers to Europe, on account of its red plumage and song.

8. *Chloris*. The Greenfinch. *Ger.* der Grünfink. *Fr.* le Verdier.—*L. flavicanti-virens, remigibus primoribus antice luteis, rectricibus lateralibus quatuor basi luteis.*

(FRISCH. Tab. 2. fig. 3, 4.)

In various parts of Europe.

9. *Oryx*. — *Ger.* der Feuervogel.—*L. grisea, rostro, fronte abdomineque nigris, collo uropygioque fulvis.*

(DAUBENTON, *Planches*. Tab. 6. fig. 2.—Tab. 134. fig. 1.)

At the Cape, &c. In Spring and Summer the male is fine red, and glossy black; in Autumn and Winter, on the contrary, of the greyish brown colour of the female.

32. *EMBERIZA*. Rostrum conicum, mandibulæ basi deorsum a se invicem discedentes; inferiore lateribus inflexo coarctata, superiore angustiore.

1. *Nivalis*. The Snow Bunting. *Ger.* die Schneeammer. *Fr.* l'Ortolan de Neige.—*E. remigibus albis, primoribus extrorsum nigris: rectricibus nigris, lateralibus tribus albis.*

(FRISCH. Tab. 6. fig. 1, 2.)

In the Northern parts of the World *. It is found in Germany only during Winter, and occasionally in innumerable flocks.

2. *Miliaria*. The Bunting. *Ger.* die Graue ammer. *Fr.* le Proyer.—*E. grisea, subtus nigro maculata, orbitis rufis.*

(FRISCH. Tab. 6. fig. 4.)

In almost every part of Europe.

3. *Hortulana*. The Ortolan. *Ger.* der Kornfink. *Fr.* l'Ortolan.—*E. remigibus nigris, primis tribus margine albidis: rectricibus nigris, lateralibus duabus extrorsum nigris.*

(V. WILDUNGEN *Taschenbuch*, f. 1803.)

In the warmer regions of Europe, and the parts of Asia near to it.

4. *Citrinella*. The Yellow-hammer. *Ger.* die Gold-ammer.

* The only living creature that is found at the height of 2000 feet above the limit of perpetual snow. (WAHLENBERG *über die Lappländischen Alpen; mit Anmerk. von HAUSMANN*. Göttingen, 1812. 4to. § 55.)

Fr. le Bruant.—*E. rectricibus nigricantibus : extimis duabus latere interiore macula alba acuta.*

(FRISCH. Tab. 5. fig. 1, 2.)

In nearly the whole of Europe.

5. *Aureola*.—*E. citrina*, vertice, toroque, dorsoque spadiceis, crisso albido, rectricibus duabus utrinque extimis fascia obliqua alba.

(*Abbild. Nat. Hist. Gegenst.* Tab. 56.)

In Siberia, as far as Kamschatka.

6. *Paradisea*. The Whidah Bird. *Ger.* die Wittwe. *Fr.* la Veuve à collier d'or.—*E. fusca*, pectore rubro, rectricibus intermediis quatuor elongatis acuminatis; duabus longissimis; rostro rubro.

(EDWARDS. Tab. 86.)

Has its English name, which has been mutilated by a mistake when transferred to other languages, from its native country, the kingdom of Whidah, on the coast of Guinea.

33. *TANAGRA*. Rostrum conicum acuminatum, emarginatum, basi subtrigonum, apice declive.

1. *Jacapa*. The red-breasted Blackbird. *Fr.* le Cardinal pourpré.—*T. atra*, fronte, jugulo pectoreque coccineis.

(EDWARDS. Tab. 267.)

In the West Indies, and the neighbouring parts of America.

34. *FRINGILLA*. Rostrum conicum rectum acuminatum.

1. *Cælebs*. The Chaffinch. *Ger.* der Buchfink. *Waldfink.* *Fr.* le Pinçon.—*F. artubus nigris*, remigibus utrinque albis, tribus primis immaculatis: rectricibus duabus oblique albis.

(FRISCH. Tab. 1. fig. 1, 2.)

In Europe and Africa: it has a great diversity of song, so that frequently the Chaffinches of a district a few miles in extent, sing very differently from those of neighbouring situations.

2. *Montifringilla*. The Bramble. *Ger.* der Bergfink. *Fr.* le Pinçon d'Ardenne.—*F. alarum* basi subtus flavissima.

(LINNE. *Fauna Suec.* Tab. 2. fig. 198.)

In the North of Europe. When the crop of beech-mast is abundant, it comes in many thousands to various parts of Germany about the end of Autumn.

3. *Nivalis*. The Snowfinch. *Ger.* der Schneefink. *Fr.* le Niverrôle.—*F. fusca*, subtus nivea, remigibus secundariis rectricibusque albis.

(BRISSEAU. Vol. III. Tab. 15. fig. 1.)

On Caucasus, and the European Alps.

4. *Carduelis*. The Goldfinch. *Ger.* der Stieglitz. *Fr.* le Char-donneret.—F. fronte et gula coccineis, remigibus antrorsum flavis: rectricibus duabus extimis medio, reliquis apice albis.

(FRISCH. Tab. 1. fig. 3, 4.)

In almost the whole of Europe, and the contiguous parts of the old Continent: produces beautiful bastards with the Canary bird. (FRISCH. Tab. 12. fig. 5.)

5. *Amandava*. The Ahmedabad-finch. *Ger.* der Fink von Bengalen. *Fr.* le Bengali piquetè.—F. fusca rufescensque albo punctata.

BUFFON. Vol. IV. Tab. 2. fig. 1.)

In the East Indies. In those which I have had the opportunity of examining I have not found the bones yellow, as has been asserted.

6. *Canaria*. The Canary Bird. *Ger.* der Canarienvogel. *Fr.* le Serin de Canarie.—F. rostro albido, corpore subfusco, pectore flavescens, rectricibus remigibusque virescentibus.

(FRISCH. Tab. 12. fig. 1-4.)

It appears to have been first brought to Europe from the Canary Islands, about the commencement of the 16th century; but has since deviated into many varieties. The wild stock-race is brownish-grey with a yellow breast. Of the others, the most remarkable are those with a plume or tuft on the head, and the Albinos with red eyes.

7. *Spinus*. The Siskin. *Ger.* der Zeisig. *Fr.* le Tarin.—F. remigibus medius luteis: primis quatuor immaculatis, rectricibus basi flavis, apice nigris.

(FRISCH. Tab. 11. fig. 1, 2.)

It builds in the tops of lofty pine and fir trees, in the depths of pine forests: hence its nests are rarely found. (See GÜNTHER'S *Nester u. Eyer verschiedener Vögel, durch WIRSING. Taf. X.*)

8. *Cannabina*. The Greater Linnet. *Ger.* der Hänfling. *Fr.* la Linotte.—F. remigibus primoribus rectricibusque nigris, utroque margine albis.

(FRISCH. Tab. 9. fig. 1, 2.)

In Europe and North America.

9. *Linaria*. The Lesser Linnet. *Ger.* der Flachsfinke. *Fr.* le Sizerin.—F. remigibus rectricibusque fuscis, margine obsolete pallido, litura alarum albida.

(FRISCH. Tab. 10. fig. 3, 4.)

Throughout the Northern parts of the World.

10. *Domestica*. The Sparrow. *Ger.* der Sperling. *Fr.* le Moineau.—*F. remigibus rectricibusque fuscis, gula nigra, temporibus ferrugineis.*

Dispersed through the whole of Europe, and the neighbouring districts of the other portions of the Old World. There are, however, individual spots in which it is not met with; as, for instance, many parts of Thuringia, and those too by no means deficient in foliage or fruits. It breeds four times in the year. It is certainly injurious to gardens and fields, but at the same time destroys incalculable quantities of vermin. Sparrows are occasionally found which are completely white.

35. *MUSCICAPA*. Fly-catcher. *Ger.* Fliegenfänger. *Fr.* Gobe-Mouche. — Rostrum subtrigonum utrinque emarginatum, apice incurvo; vibrissæ patentés versus fauces.

1. *Atricapilla*. The Pied Fly-catcher. *Ger.* der Fliegenschnäpper. *Fr.* le Gobe-mouche à collier.—*M. nigra subtus, frontis macula alarumque speculo albis, rectricibus lateralibus extus albis.*

(FRISCH. Tab. 24. fig. 1.)

Scattered through Europe.

36. *MOTACILLA*. Rostrum subulatum rectum: mandibulis subæqualibus.

1. *Luscinia*. The Nightingale. *Ger.* die Nachtigall. *Fr.* le Rossignol.—*M. rufo-cinerea armillis cinereis.*

(FRISCH. Tab. 21. fig. 1, 2.)

In the temperate regions of Europe and Asia. Comes to Germany in April, and in August departs again; it is not exactly known whither; as far as can be ascertained, not to Africa.

2. *Curruca*. The Hedge Sparrow. *Ger.* die Grasmücke. *Fr.* la Fauvette.—*M. supra fusca, subtus albida, rectricibus fuscis; extima margine tenuiore alba.*

(FRISCH. Tab. 21. fig. 3.)

In the temperate parts of Europe.

3. *Ficedula*. The Beccafica.—*M. subfusca, subtus alba, pectore cinereo maculato.*

(FRISCH. Tab. 22. fig. 3, 4.)

In the milder and hotter parts of Europe, particularly Cyprus, whence it has been widely dispersed on account of the delicate flavour of its flesh.

4. *Alba*. The White Water-wagtail. *Ger.* das Ackermännchen.

Fr. la Lavandière.—*M. pectore nigro, rectricibus duabus lateralibus dimidiato-oblique albis.*

(FRISCH. Tab. 23. fig. 4.)

In almost the whole of the Old World.

5. *Calliope.*—*M. mustelina, olivaceo-maculata, subtus ex flavesciente alba, gula miniata, linea alba nigraque cincta, loris nigris, superciliis albis.*

(*Abbild. Nat. Hist. Gegenst.* Tab. 45.)

In Siberia, Kamschatka, &c.

6. *Atricapilla.* The Black-Cap. *Ger. der Klosterwenzel. Fr. la Fauvette à Tête noire.*—*M. testacea, subtus cinerea, pileo obscuro.*—(LINN. *Faun. Suec.* Tab. 1. fig. 236.)

In temperate Europe. One of the most pleasing singing birds.

7. *Phenicurus.* The Redstart. *Ger. das Rothschwänzchen. Fr. le Rosignol de Muraille.*—*M. gula nigra, abdomine caudaque rufis, capite dorsoque cano.*

(FRISCH. Tab. 19. fig. 1.)

Found in nearly the same places as the Nightingale, and comes and goes at the same time with it.

8. *Rubecula.* The Robin Redbreast. *Ger. das Rothbrüstchen. Fr. le Rouge-gorge.*—*M. grisea, gula pectoreque ferrugineis.*

(FRISCH. Tab. 19. fig. 2.)

In most parts of Europe. It remains during Winter, and is very serviceable by destroying many noxious insects.

9. *Suecica.*—*M. pectore ferrugineo fascia cærulea, rectricibus fuscis versus basin ferrugineis.*

(FRISCH. Tab. 19. fig. 2. a. b.)

Principally near water in the mountainous districts of the temperate parts of the Old World.

10. *Troglodytes.* The Wren. *Ger. der Zaunkönig.*—*M. grisea, alis nigro cinereoque undulatis.*

(FRISCH. Tab. 24. fig. 3.)

In the Northern World. It makes a covered nest, almost in the shape of an oven *, and lays many eggs.

11. *Regulus.* The Gold-crowned Wren. *Ger. das Goldhähnchen. Fr. le Roitelet.*—*M. remigibus secundariis exteriori margine flavis, medio albis, crista verticali crocea.*

(FRISCH. Tab. 24. fig. 4.)

Likewise in the Northern World. The smallest European bird.

* NOZEMANN *en* SEPP *Nederlandsche Vogelen.* Tab. 59. p. 111.

12. *Sartoria*. The Tailor-bird.—*M. tota pallide lutea*.

(J. R. FORSTER'S *Indian Zoology*. Tab. 8.)

In India. Smaller than a Wren. It has its name from the art with which it makes its nest, sewing some dry leaves to a green one at the extremity of a twig, and thus forming a hollow cone, which it afterwards lines with feathers.

37. *PIPRA*. Rostrum capite brevius, basi subtrigonum integerrimum, apice incurvum. Pedes gressorii.

1. *Rupicola*. The Manakin. *Fr.* le Coq de Roche.—*P. crista erecta margine purpurea, corpore croceo, tectricibus rectricum truncatis*.

(EDWARDS. Tab. 264.)

In Guiana, &c.

38. *PARUS*. Titmouse. *Ger.* Meise. *Fr.* Mésange.—Rostrum integerrimum, basi setis tectum.

1. *Major*. The Great Titmouse. *Ger.* die Kohlmeise. *Fr.* la Charbonnière.—*P. capite nigro, temporibus albis, nucha lutea*.

(FRISCH. Tab. 13. fig. 1, 2.)

In almost the whole of the Old World. A bold animal, attacking much larger birds, and pecking open the heads of the smaller singing birds. It has been remarked of this and other Species of this Genus which remain with us in the Winter, that during that season the bill becomes harder than in Summer, and is, consequently, better suited for taking their food from the frozen ground.

2. *Cæruleus*. The Nun. *Ger.* die Blaumeise. *Fr.* la Mésange bleue.—*P. remigibus cærulescentibus; primoribus margine exteriori albis, fronte alba, vertice cæruleo*.

(FRISCH. Tab. 14. fig. 1.)

Very common in Europe. Destroys innumerable noxious insects.

3. *Caudatus*. The Long-tailed Titmouse.—*P. vertice albo, cauda corpore longiore*.

(FRISCH. Tab. 14. fig. 3.)

In Europe and the West Indies: lays as many as twenty eggs; builds a bag-shaped nest, and covers it exteriorly with the moss with which the tree it is placed in is overgrown.

4. *Biarmicus*. The Bearded Titmouse. *Ger.* das Bartmännchen. *Fr.* le Moustache.—*P. vertice cano, cauda corpore longiore, capite barbato*.

(FRISCH. Tab. 8. fig. 3.)

In the North-west of Europe, England, &c.

5. *Pendulinus*. The Penduline Titmouse. *Ger.* der Remitz. *Fr.* la Mésange de Pologne.—*P.* capite subferrugineo, fascia oculari nigra, remigibus rectricibusque fuscis margine utroque ferrugineo.

(J. D. TITII *Parus minimus Remiz descriptus*. Lips. 1755. 4to. Tab. 1, 2.)

Here and there in Austria, Upper Italy, Poland, Siberia, &c. It builds a bag-shaped nest, and suspends it from a slender twig.

39. *HIRUNDO*. Rostrum minimum incurvum, subulatum, basi depressum.

The Swallows are distinguished from the other animals of this Order, as well by their form as by their mode of life. Notwithstanding all that has been written on the disputed question of the Winter retreat of the Swallows of our own climates, but little appears to be certainly known. It is a pity that in all the observations advanced in support of one or other side of the disputed points, the species on which they were made, have not been determined with precision*. On the whole, however, their emigration to warmer regions appears to unite the greater number of probabilities in its favour.

1. *Domestica* The House Swallow. *Ger.* der Rauchschnalbe. *Fr.* l'Hirondelle de Cheminée. (*Hirundo rustica*. LINN.)—*H.* rectricibus, exceptis duabus intermediis, macula alba notatis, fronte et gula spadiceis.

(FRISCH. Tab. 18. fig. 1.)

Together with the Sand Martin, one of the most widely dispersed birds. The names of this, and the following Species, have been singularly mixed and confounded by systematic writers. This Species, with naked legs and speckled tail-feathers, builds its open nest, which often swarms with bugs, in the roofs of houses, stables, barns, and in villages over doors, and in chimneys.

2. *Agrestis*. The Martin. *Ger.* die Hausschnalbe. *Fr.* l'Hirondelle de fenêtre.—*H.* pedibus hirsutis, rectricibus im-maculatis, dorso cærulescente, tota subtus alba.

(FRISCH. Tab. 17. fig. 2.)

* GUENAU DE MONBEILLARD has collected and examined the proofs of their emigration in BUFFON'S *Histoire des Oiseaux*. Vol. IV. p. 557.

The most zealous modern supporter of the torpidity of Swallows during Winter was DAINES BARRINGTON. See his *Miscellanies*, p. 225.

Three different Essays in support of the same opinion are contained in the *Memoirs of the American Academy of Arts and Sciences*, at Boston. Vol. I. p. 494. Vol. II. p. 93, 94.

Principally in the Northern World. It mostly builds in villages, under the eaves of houses, church-windows, &c. Its nest is made of lumps of clay, and is vaulted above.

3. *Riparia*. The Sand Martin. *Ger.* die Uferschwalbe. *Fr.* l'Hirondelle de Rivage.—*H. cinerea, gula abomineque albis.*
(FRISCH. Tab. 18. fig. 2.)

Builds in the banks of rivers, in clay-pits, sand-hills, &c.

4. *Esculenta*. The Salangane.—*H. rectricibus omnibus macula alba notatis.*

Of the size of the Wren. It comes from the Sunda, and other islands of the Indian Archipelago, New Guinea, &c. It builds the celebrated Indian nests, the materials of which resemble isinglass, in holes on shores and hills. At least four millions of these nests are collected annually, and mostly exported to China.

5. *Apus*. The Black Martin. *Ger.* die Mauerschwalbe. *Fr.* le Martinet.—*H. nigricans, gula alba, digitis omnibus quatuor anticis.*

(FRISCH. Tab. 17. fig. 1.)

In all three divisions of the Northern World.

40. *CAPRIMULGUS*. Rostrum modice incurvum, minimum, subulatum, basi depressum; vibrissæ ciliares. Rictus amplissimus; unguis intermedius introrsum ciliatus.

1. *Europeus*. The Goat-sucker. *Ger.* die Nachtschwalbe. *Fr.* l'Engoulevent.—*C. narium tubis obsoletis.*

(FRISCH. Tab. 101.)

In the Old World. A nocturnal animal. It makes a purring noise in flying. It lives on insects, particularly moths, &c. The old tale that it sucks the milk of Goats, is wholly unfounded.

VI. GALLINÆ.

The Birds of this Order have short legs, with a convex bill, which is covered with a fleshy membrane at its base, and of which the upper half overlaps the lower on each side. They feed mostly on grains, which they soften in the crop: they lay many eggs, and form the largest part of our poultry.

41. *COLUMBA*. Rostrum rectum versus apicem descendens*.

(a.) *Cauda aequali modica.*

1. *Oenas*. The Stock-dove. *Ger.* die Holztaube. *Fr.* le Biset.

* *Les Pigeons*—par Madame KNIP, le Texte par C. J. THEMMINCK.
Paris, 1811, &c. gr. folio.

—*C. cærulescens*, cervice viridi nitante, dorso postico albo, fascia alarum apiceque caudæ nigricante.

(*Sylvan*, von LAUROF und FISCHER. f. 1815.)

The Stock-dove is a native of almost the whole of the Old World. Those of the North emigrate in Autumn into more Southerly districts. Those of more temperate climates, on the contrary, pass the Winter in flocks, in the fissures of rocks, hollow trees, &c. The female, in the wild state, breeds twice, but when domesticated, nine or ten times in the year; so that a single couple would, in four years, produce 14,762. The principal varieties (of which some are considered as distinct species), are as follows:—

(a.) *Dasytus*. The Rough-footed Dove. *Ger.* die Trommel-taube. *Fr.* le Pigeon pattu. The feet with long feathers.—(FRISCH. Tab. 145.)

(b.) *Gutturosa*. The Cropper. *Ger.* der Kröpfer. *Fr.* le Grand Gosier. With a monstrous crop.—(FRISCH. Tab. 146.)

(c.) *Turbita*. The Turbit. *Ger.* das Mówchen. *Fr.* le Pigeon cravate. With frizzly feathers on the breast, and a very short bill.—(FRISCH. Tab. 147.)

(d.) *Gyratrix*. The Tumbler. *Ger.* der Tümmeler. *Fr.* le Pigeon culbutant. With a smooth head, and a bare red circle round the orbit: it throws itself over when rising.—(FRISCH. Tab. 148.)

(e.) *Cucullata*. The Jacobin. *Ger.* die Schleiertaupe. *Fr.* le Pigeon nonain. With a bunch of feathers on the head, turning forwards.—(FRISCH. Tab. 159.)

(f.) *Laticauda*. The Fan-tail. *Ger.* die Pfauentaube. *Fr.* le Pigeon paon. With upright expanded tail.—(FRISCH. Tab. 151.)

(g.) *Tabellaria*. The Carrier. *Ger.* die Posttaube. *Fr.* le Pigeon messenger. With red warty growths about the bill and eyes. This Variety has its name from the service to which it was formerly applied, particularly in the Levant, of carrying letters *.

2 *Coronata*. The great crowned Indian Pigeon. *Ger.* der Kronvogel.—*C. cærulescens*, supra cinerea, orbitis nigris, crista erecta, humeris ferrugineis.

(J. F. MILLER. *Fasc.* III. Tab. 16.)

Principally in New Guinea, the Molucca Islands, &c. Almost as large as a turkey.

3. *Palumbus*. The Ring-dove. *Ger.* die Ringtaube. *Fr.* le Pi-

* S. the *Göttingischer Taschen-Kalender*, 1790.

geon ramier.—C. rectricibus postice atris, remigibus primoribus margine exteriori albidis, collo utrinque albo.

(*Sylvan*, von LAUROF und FISCHER. f. 1815.)

In almost the whole of Europe.

4. *Turtur*. The Turtle Dove. *Ger.* die Turteltaube. *Fr.* la Tourterelle.—C. rectricibus apice albis, dorso griseo, pectore incarnato, macula laterali colli nigra lineolis albis.

(*Sylvan*, von LAUROF und FISCHER. f. 1815.)

In the hotter and more temperate parts of the Old World. As to its so highly prized fidelity and chastity, setting aside idle fables, it presents nothing superior to other birds, which lead the same mode of life.

5. *Risoria*. The Indian Turtle. *Ger.* die Lachstaube. *Fr.* la Tourterelle à collier.—C. supra lutescens lunula cervicali nigra.

(FRISCH. Tab. 141.)

In the milder parts of Europe, and in the East Indies.

(*b.*) *Cauda longiore cuneato*.

6. *Migratoria*. The Migratory Pigeon. *Ger.* die Zugtaube.—C. orbitis denudatis sanguineis, pectore rufo.

(FRISCH. Tab. 142.)

In the North-east of America. At the time of their emigrations they furnish a copious supply of food to the Indians, by whom they are smoked and dried in thousands.

42. *TETRAO*. Macula prope oculos nuda, papillosa.

1. *Coturnix*. The Quail. *Ger.* die Wachtel. *Fr.* la Caille.—T. Pedibus nudis, corpore griseo maculato, superciliis albis, rectricum margine lunulaque ferruginea.

(*v.* WILDUNGEN *Taschenbuch*, f. 1802.)

In almost every part of the Old World: a bird of passage, occasionally seen in vast numbers.

2. *Perdix*. The Partridge. *Ger.* das Rebhuhn. *Fr.* la Perdrix grise.—T. pedibus nudis calcaratis, macula nuda coccinea sub oculis, cauda ferruginea, pectore sub fusco.

(*v.* WILDUNGEN *Taschenbuch*, f. 1799.)

In the middle parts of Europe, and the warmer districts of Asiatic Russia.

3. *Rufus*. The Red Partridge.—T. pedibus nudis calcaratis rostroque sanguineis, gula alba cincta fascia nigra albo punctata.

(*v.* WILDUNGEN *Taschenbuch*, f. 1797.)

In the South of Europe and the Levant. It is domesticated in the Islands of the Archipelago.

4. *Bonasia*. The Hazel-hen. *Ger.* das Haselhuhn. *Fr.* la Gelinotte.—T. pedibus hirsutis, rectricibus cinereis punctis, nigris fascia nigra; exceptis intermediis duabus.

(v. WILDUNGEN *Taschenbuch*, f. 1796.)

Lives solitary in the hazel-bushes of the middle of Europe: the Swedish (Hjärpe) is the most delicate of all game.

5. *Lagopus*. The White Game. *Ger.* das Schneehuhn. *Fr.* la Gelinotte blanche.—T. pedibus lanatis, remigibus albis, rectricibus nigris, apice albis: intermediis albis.

(v. WILDUNGEN *Taschenbuch*, f. 1800.)

In the Alpine and Northern regions of the Old and New Worlds: is of a grey colour in Summer: and is of great value to the European Colonists of Labrador and Greenland.

6. *Tetrix*. The Black Cock. *Ger.* der Birkhahn. *Fr.* le petit Tetras.—T. pedibus hirsutis, cauda bifurcata, remigibus secundariis versus basin albis.

(v. WILDUNGEN *Taschenbuch*, f. 1795.)

In the North of the Old World.

7. *Urogallus*. The Cock of the Wood. *Ger.* der Auerhahn. *Fr.* le Coq de Bruyère.—T. pedibus hirsutis, cauda rotundata, axillis albis.

(v. WILDUNGEN *Taschenbuch*, f. 1794.)

In the North of Europe. Its sight and hearing are extremely acute: its tongue and upper larynx are placed low down in the neck.

43. *NUMIDA*. Caput cornutum, collum compressum coloratum; palearia carunculacea ad latera maxillæ utriusque.

1. *Meleagris*. The Guinea Hen. *Ger.* das Perlhuhn. *Fr.* la Peintade.—N. rostro cera instructo nares recipiente.

(FRISCH. Tab. 126.)

This creature, so remarkably spotted with white, is a native of the North and West of Africa; but has long been naturalized in Europe, and many parts of America.

44. *MENURA*. Cauda elongata, plana, rectricibus 16; duabus intermediis angustis, longioribus; duabus externis apice dilatato exterius recurvo: reliquis laxis.

1. *Superba*. (AUDEBERT et VIEILLOT.—*Oiseaux de Paradis*. Tab. 14, 15, 16.)

From New Holland. The male bird, on account of his large, wonderfully formed, and beautifully coloured tail, is one of the most splendid animals of the whole class.

45. PHASIANUS. Genæ cute nuda lævigata.

1. *Gallus*. The Cock. *Ger.* der Haushahn. *Fr.* le Coq.—Ph. caruncula compressa verticis geminaque gulæ, auribus nudis, cauda compressa ascendente.

That which is probably the original stock, is found wild in Hindostan * ; it is of a reddish brown colour, and is distinguished by the flat horny plates at the points of the neck and wing feathers, and which resemble the vermilion red plates on the wings of the Bohemian Chatterer. The domestic fowl is dispersed over almost the whole of the globe : it was first introduced into America by the Spaniards ; whilst, on the contrary, it was found in many of the South Sea Islands on their discovery by the Europeans. From the number of its eggs, and the frequency which it lays them, it is one of the most useful animals of the whole class.—Cock-fights have long been a favourite amusement in many parts of the world.

Among the animals of this Class, the domestic fowl is that which has deviated into the most numerous and most remarkable Races and Varieties : certain monstrosities have become hereditary † ; as well *per defectum*, (—§ 12.—) as the fowls without tails ; as *per excessum*, (l. c.) as those with five or even six toes ‡.

Of others these deserve notice :—

- (a.) *The Paduan Fowl*, as large again as the common one.
- (b.) *The Dwarf Fowl*, scarcely one half of its size.
- (c.) *The Friesland Fowl*, with frizzly feathers turning outwards.
- (d.) *The Japan Fowl*, from Japan, China, &c. Its feathers are smooth, almost like hair, and hence have arisen the fables of bastards between fowls and rabbits.

* SONNERAT, *Voyage aux Indes*. Vol. II. Tab. 94, 95.

† Thus, in the crested fowl, as it is called, with a thick tuft of feathers on the head, the frontal part of the skull is expanded into a monstrous hollow shell covering the brain ; an hereditary aberration of the *Nisus formativus*, unequalled in its way, and which I have described and illustrated by anatomical representations in my *Commentatio de Nisus formativi aberrationibus*.

‡ On the well known, but still, in a physiological point of view, remarkable experiment, of procuring the adhesion of the spur of a cock to its comb. See DUHAMEL in the *Mem. de l'Acad. des Sciences de Paris*, 1746. p. 349, &c.

(e.) *The Negro Fowl*, with a black skin. Principally from St. Jago, in the Cape de Verd Islands, where other species of birds are also said to present the same peculiarity.

2. *Colchicus*. The Pheasant. *Ger.* der Fasan. *Fr.* le Faisan. *Ph.* rufus, variegatus, capite viridi cærulescente, cauda cuneata, genis papillosis.

(V. WILDUNGEN *Taschenbuch*, f. 1797.)

Has its name from the river Phasis, in Mingrelia, whence it was first brought to Europe by the Argonauts.

3. *Argus*. The Chinese Pheasant. — *Ph.* fusco-flavescens, nigro punctatus et undulatus, remigum 11 interiorum latere exteriori ocellato, genis nudis, occipite nigro subcristato, rectricibus 2. intermediis longissimis.

(*Philos. Trans.* Vol. LV. Tab. 3.)

In its kind one of the most wonderfully beautiful and splendid creatures in nature. In particular, the large eyes on the inner wing feathers are shaded in an indescribably beautiful manner, with, as it were, a spot of light on each. It measures nine feet from the bill to the point of the tail, and, together with the two next species, is a native of China.

4. *Pictus*. The Golden Pheasant. — *Ph.* crista flava, pectore coccineo, remigibus secundariis cæruleis, cauda cuneata.

(EDWARDS. Tab. 68, 69.)

In this and the following Species the adult males are distinguished by the remarkable beauty of their plumage.

5. *Nyctemerus*. The Silver Pheasant. — *Ph.* albus, crista abdomineque nigris, cauda cuneata.

(EDWARDS. Tab. 66.)

46. CRAX. Rostrum basi cera obductum in utraque mandibula. Pennæ caput tegentes revolutæ.

1. *Alector*. The Curasso. — *C.* cera flava, corpore nigro, ventre albo.

(BUFFON. Vol. II. Tab. 13.)

In Guinea, &c.

47. MELEAGRIS. Caput carunculis spongiosis tectum, gula caruncula membranacea longitudinali.

1. *Gallopavo*. The Turkey. *Ger.* der Wälsche Hahn. *Fr.* le Dindon. — *M.* maris pectore barbato.

In the middle and Northern parts of America, living on trees, in flocks of many hundreds. It was brought to Germany in 1530, where it has become domestic, and has deviated into many varieties of white and other colours.

48. *Pavo*. Caput pennis révolutis tectum, pennæ caudales elongatæ, ocellatæ.

1. *Cristatus*. The Peacock. *Ger.* der Pfau. *Fr.* le Paon.—
P. capite crista compressa, calcaribus solitariis.

Is originally a native of the East Indies, and was introduced into Europe in the time of Alexander the Great. The male is distinguished from its third year, by the splendour of its tail, or rather its back feathers. Of the varieties, the white is the most remarkable.

49. *Otis*. Rostrum mandibula superiore fornicata; pedes cursorii.

1. *Tarda*. The Bustard. *Ger.* der Trappe. *Fr.* l'Outarde.—
O. maris capite juguloque utrinque cristato.

(v. *WILDUNGEN Taschenbuch*. f. 1796.)

This, the largest bird of our own countries, is a native of the temperate parts of Europe. The male weighs full 30lbs, and has a large pouch in front of the neck, concealed, and opening under the tongue.

VII. STRUTHIONES.

Large land birds, with loose unconnected toes, and short wings or pinion feathers, unsuited for flight.

50. *STRUTHIO*. Rostrum subconicum; pedes cursorii.

1. *Camelus*. The Ostrich. *Ger.* der Straus. *Fr.* l'Autruche.
 —*S.* pedibus didactylis, digito exteriori parvo mutico, spinis alarum binis.

(*LATHAM*. Vol. III. p. 1. Tab. 71.—*Abbild. Nat. Hist. Gegenst.* Tab. 77.)

The largest of all birds, which reaches the height of eight feet and upwards, and is almost confined to Africa and Arabia: its incapability of flying is compensated by the exceeding speed with which it runs*: each of its eggs, of which it lays about 30, contains as much as 24 hen's eggs: it is principally valuable on account of its feathers.

The American Ostrich (*Str. rheas*), is a native of Chili in particular.

2. *Casuarius*. The Cassowary.—*S.* pedibus tridactylis, galea palmaribusque nudis, remigibus spinosis.

(*Abbild. Nat. Hist. Gegenst.* Tab. 97.)

In the East Indies: has great force in its middle claws: its feathers are horny, and look like horse hair, two of them being attached to each quill.

* Volat curriculo. *PLAUT.*

A peculiar species of Cassowary without a helmet, (*Str. australis*.) has been lately discovered in the fifth part of the World, in New South Wales.

51. *DIDUS*. Rostrum medio coarctatum rugis duabus transversis : utraque mandibula inflexo apice ; facies ultra oculos nuda.

1. *Ineptus*. The Dodo. *Ger.* der Dudu. *Fr.* le Dronte. (*Cygnus cucullatus*.)—*D.* pedibus ambulatoriis, cauda brevissima, pennis incurvis.

(*Abbild. Nat. Hist. Gegenst. Tab. 35.*)

Formerly in the Isles of France and Bourbon : but, according to the assurances of MOREL, who made his inquiries on the spot, it exists no longer : nor is this improbable, as it is one of the most unwieldy awkward animals of the whole Class, consequently easily taken ; and yet, on account of the indifferent flavour of its flesh, of little use*.

*So far of Land Birds.—Next of Water Birds, in
Two Orders.*

VIII. GRALLÆ.

These Birds have cylindrical bills of various lengths, long stilt-like legs, for the most part a long neck, and a short tail. They mostly live in moist marshy grounds, feed on Amphibia, Fish, Insects, and Water-plants, build on the ground or among reeds, and are mostly valuable on account of the delicate flavour of their flesh and eggs.

52. *PHENICOPTERUS*. Rostrum denudatum, infracto-incurvatum, denticulatum, pedes tetradactyli.

1. *Ruber*. The Flamingo.—*S.* ruber, remigibus nigris.

(*Sylvan, von LAUROP und FISCHER. f. 1814.*)

On the Sea-coasts of the warmer parts of the World : its body is of moderate size, but its neck and legs so long as to make it full as tall as a man.

53. *PLATALEA*. Rostrum planiusculum ; apice dilatato, orbiculato, plano. Pedes tetradactyli semipalmati.

1. *Leucorodia*. The Spoon-bill. *Ger.* die Löffelgans. *Fr.* la Spatule.—*P.* corpore albo, gula nigra, occipite subcristato.

(*FRISCH. Tab. 200, &c.*)

Scattered through different parts of the Western World.

* I have spoken of this and other proofs of the changes which take place in the Creation, in my *Beyträge zur Natur-Geschichte*, Th. I. S. 24, &c.

54. *PALAMEDEA*. Rostrum conicum, mandibula superiore adunca. Pedes tetradactyli, fissi.

1. *Cornuta*. The horned Screamer.—*P. alulis bispinosis*, fronteque cornuta.

(LATHAM. Vol. III. p. 1. Tab. 74.)

In the Savannahs of the Eastern parts of South America.

55. *MYCTERIA*. Rostrum subadscendens, acutum : mandibula superiore triquetra : inferiore trigona acuminata adscendente : frons calva : nares lineares : pedes tetradactyli.

1. *Americana*. The Jabiru. *Fr. la Cicogne du Brezil.*

(LATHAM. *l. c.* Tab. 26.)

A native of the same places with the species above.

56. *CANCROMA*. Rostrum gibbosum ; mandibula superiore cymbæ resupinatæ forma.

1. *Cochlearia*. The Boat-bill. *Ger. der Hohl-schnabel. Fr. la Cuillière.—C. ventre rufescente.*

(LATHAM. *l. c.* Tab. 26.)

Also in Brazil, &c.

57. *ARDEA*. Rostrum rectum, acutum, longum, subcompressum ; pedes tetradactyli.

1. *Pavonina*. The Royal Crane. *Ger. der Kron-Kranich. Fr. l'Oiseau Royal.—A. crista setosa erecta, temporibus pallearibusque binis nudis.*

(BUFFON. Vol. VII. Tab. 11.)

In South Africa. The feathers in its beautiful crown are wound spirally in a remarkable manner.

2. *Grus*. The Crane. *Ger. der Kranich. Fr. la Grue.—A. occipite nudo papilloso, corpore cinereo, alis extus testaceis.*

(v. WILDUNGEN *Taschenbuch*, f. 1797.)

In the Northern parts of the Old World.

3. *Ciconia*. The Stork. *Ger. der Storck. Fr. la Cicogne.—A. alba, orbitis nudis remigibusque nigris ; rostro, pedibus cuteque sanguineis.*

In the more temperate parts of almost the whole of the Old World : it lives not only on Amphibia, but also destroys useful animals, whole broods of partridges for instance ; it frequently carries linen, thread, &c., to its nest, for the purpose of lining it*.

4. *Major*. The Heron. *Ger. der Reiher. Fr. le Héron.—A.*

* For some good observations on the Stork, see the *Hanoverian Magazine*, 1809. p. 96.

occipite crista nigra dependente, corpore cinereo, collo subtus linea fasciaque pectorali nigris.

(FRISCH. Tab. 199.)

In almost every part of both Worlds. Noxious animals, particularly destructive to fish ponds, and the young brood in them: they build in lofty trees, oaks, &c *.

5. *Garzetta*. The Egret. *Fr.* l'Aigrette.—A. occipite cristato, corpore albo, rostro nigro, loris pedibusque virescentibus.

(BUFFON. Vol. VII. Tab. 25.)

Particularly in Persia: the feathers of the back are long, silver white, silky, and very valuable.

6. *Stellaris*. The Bittern. *Ger.* die Rohrdommel. *Fr.* le Butor A. capite læviusculo, supra testacea maculis transversis, subtus pallidior maculis oblongis fuscis.

(V. WILDUNGEN *Taschenbuch*, f. 1808.)

In the temperate regions of the Northern World.

58. TANTALUS. Rostrum longum, subulatum, teretiusculum, subarcuatum: facies nuda ultra oculos: pedes tetradactyli, basi palmati.

1. *Ibis*. (*Tantalus æthiopicus*. LATHAM. *Numenius ibis*. CUVIER.)—T. albus remigum apicibus, rostro et pedibus nigris, remigibus secundariis elongatis nigro-violaceis.

(*Abbild. Nat. Hist. Gegenst.* Tab. 86.)

This is the animal so famed among the ancient Egyptians, as the symbol of the overflowing of the Nile †: it has been frequently represented on their hieroglyphical monuments, and prepared, like the human bodies, in the form of Mummies ‡, great numbers being placed in certain vaults. At present it is rather uncommon there, at least in Lower Egypt §. The smaller black Ibis appears to be identical with the Tantalus

* The Heron's feathers from the Levant, which I have seen, differ from those of our own countries, in being of a finer colour, but not at all in their form or flexibility. Those, on the contrary, which are so different in form and colour, are procured from the *Garzetta*.

† For its arrival, breeding season, and departure, coincided with the commencement, &c., of the fertilizing inundation of that river. See J. C. SAVIGNY, *Hist. Nat. et Myth. de l'Ibis*.

‡ I have given an account in the *Phil. Trans.* 1794, of two such Mummies, which I had an opportunity of examining in London. See also C. A. LANGOUTH, *de Mum. avium in labyrintho apud Sacaram repertis*. Viteb. 1803. 4to. with plates.

§ On the other hand, this Ibis is found in South Africa, whence (from Cape Town) I have received specimens, by the kindness of the Rev. M. HESSE.

falcinellus, met with in the South of Germany and other parts of Europe.

69. *SCOLOPAX*. Rostrum teretiusculum, obtusum, capite longius, facies tecta, pedes tetradactyli, postico pluribus articulis insistente.

1. *Arquata*. (Numenius.) The Curlew. *Ger.* die Brachschnepfe. *Fr.* le Courlis.—S. rostro arcuato, pedibus cæruleis, alis nigris maculis niveis.

(v. WILDUNGEN *Taschenbuch*, f. 1809.)

Widely dispersed over the coasts of the Northern World.

2. *Rusticula*. The Woodcock. *Ger.* die Waldschnepfe. *Fr.* la Becasse.—S. rostro basi rufescente, pedibus cinereis, femoribus tectis, fascia capitis nigra.

(v. WILDUNGEN *Taschenbuch*, f. 1801.)

In the warmer parts of the North of the Old World.

3. *Gallinago*. The Snipe. *Ger.* die Heerschnepfe. *Fr.* la Becassine.—S. rostro recto, tuberculato, pedibus fuscis, frontis lineis fuscis quaternis.

(v. WILDUNGEN *Taschenbuch*, f. 1803.)

In almost every part of the Northern World.

60. *TRINGA*. Rostrum teretiusculum longitudine capitis, digito postico uni-articulato, a terra elevato.

1. *Pugnax*. The Ruff. *Ger.* der Rampfhahn. *Fr.* le Combatant.—T. rostro pedibusque rubis, rectricibus tribus lateribus immaculatis, facie papillis granulatis carneis.

(FRISCH. Tab. 232.)

In the North of the Old World. It has its name from the ferocity with which the males attack each other at the pairing time.

2. *Vanellus*. (*Gavia*.) The Lapwing. *Ger.* der Kybitz. *Fr.* le Vanneau.—T. pedibus rubris, crista dependente, pectore nigro.

(FRISCH. Tab. 213.)

Also in the Northern parts of the Old World.

61. *CHARADRIUS*. Plover. *Ger.* Regenpfeiffer. *Fr.* Pluvier.—Rostrum teretiusculum, obtusum. Nares lineares. Pedes cursorii, tridactyli.

1. *Hiaticula*. The Sea-Lark. *Ger.* die See-lerche. *Fr.* le Pluvier à collier.—C. pectore nigro, fronte nigricante fasciola alba, vertice fusco, pedibus luteis.

(FRISCH. Tab. 214.)

On the banks of rivers in different parts of the Old World : found also on the Sandwich Islands.

62. *RECURVIROSTRA*. Rostrum depresso-planum, subulatum, recurvatum, acuminatum, *apice flexili*. Pedes palmati, tridactyli.

1. *Avosetta*. The Avosette.—R. albo nigroque varia.

(BUFFON. Vol. VIII. Tab. 38.)

In the temperate parts of the Old World. It lives principally on water insects and worms, which it seizes very dexterously with its singularly shaped bill.

63. *HÆMATOPUS*. Rostrum compressum, apice cuneo æquali ; pedes cursorii tridactyli.

1. *Ostralegus*. The Sea Pie. *Ger.* der Austerdieb. *Fr.* l'Huitrier.—H. rostro pedibusque rubris.

(LATHAM. Vol. III. p. 1. Tab. 84.)

On different parts of the Sea-coasts of every part of the World : it lives principally on shell-fish.

64. *FULICA*. Rostrum convexum, mandibula superiore margine supra inferiorem fornicata ; *frons calva*, pedes tetradactyli, subpinnati.

1. *Porphyrio*. The purple Water-hen. *Fr.* la Poule Sultane.—F. pedibus fassis, fronte pedibusque rubris, corpore viridi subtus violaceo.

(BUFFON. Vol. III. Tab. 17.)

On many shores and islands in the warmer regions of all the five parts of the World. Its shape is slight and elegant, and its plumage a splendid violet and glittering green. It is easily tamed.

2. *Atra*. The Coot. *Ger.* das schwarze Blässhuhn. *Fr.* la Foulque.—F. pedibus pinnatis fronte incarnata, armillis luteis, corpore nigricante.

(FRISCH. Tab. 209.)

In the temperate parts of the Northern World.

65. *PARRA*. Rostrum teretiusculum, obtusiusculum. Nares ovatae in medio rostri. Frons carunculata, carunculis lobatis. Alulae spinosae.

1. *Jacana*. The Spur-winged Water-Hen. *Fr.* le Chirurgien, Chevalier.—P. unguibus posticis longissimis, pedibus viridescentibus.

(BUFFON. Vol. VIII. Tab. 16.)

In the West Indies, Brazil, &c.

66. *RALLUS*. Rostrum basi crassius, compressum, dorso

attenuatum apicem versus, æquale, acutum; pedes tetradactyli, fissi.

1. *Crex*. The Rail. *Ger.* der Wachtelkönig. *Fr.* le Râle de genet.—*R. alis rufo-ferrugineis*.

In the temperate parts of the Old World. It has received the name of King of the Quails (in German), from the erroneous idea formerly entertained that it led them in their migrations.

67. *PSOPHIA*. Rostrum cylindrico-conicum, convexum, acutiusculum, mandibula superiore longiore.—*Nares ovatæ, patulæ. Pedes tetradactyli, fissi.*

1. *Crepitans*. The Trumpeter. *Ger.* der Agami. *Fr.* l'Oiseau trompette.—*P. nigra, pectore columbino.*

(*LATHAM*. Vol. II. p. 2. Tab. 68.)

In South America, and in great numbers along the River Amazon. It is very doc andile, much attached to its master.

IX. ANSERES.

The Birds of this Order are distinguished by their webbed feet, which are placed far back, and are thereby better adapted for rowing, but less so for walking. The upper mandible mostly ends in a little hook, and, together with the lower, is in most instances covered by a membrane plentifully supplied with nerves. (See Remark to § 64.) They have for the most part a fleshy tongue, a rough prickly palate, and in many instances in the male, a peculiar long or gristly capsule in front of the wind-pipe. Their plumage is thick and oily, not absorbing water. They are mostly polygamous, and live on the shores of seas, lakes and rivers, on islands, cliffs, among reeds, &c. They commonly lay but one or a small number of eggs; but are useful in various ways—for their flesh, their fat, feathers, &c.

68. *RHINCHOPS*. Rostrum rectum, mandibula superiore multo brevior; inferiore apice truncata.

1. *Nigra*. The Sea Crow. Cutwater. *Ger.* der Wasserschneider. *Fr.* Le Bec en Ciseaux.—*R. nigricans, subtus alba, rostro basi rubro.*

(*BRISSON*. T. 6. Tab. 21. fig. 2.)

In North America. The upper mandible is shorter than the lower, and is embraced by it like the blade of a pocket-knife by its handle.

69. *STERNA*. Rostrum edentulum, subulatum, subrectum,

acutum, compressiusculum. Nares lineares ad basin rostri.

1. *Stolida*. The Noddy. *Fr.* le Fou, le Diable.—S. corpore nigro, fronte albicante, superciliis atris.

(BRISSEAU. T. 6. Tab. 18. fig. 2.)

In all the Seas between the Tropics.

2. *Hirundo*. The Silver-Bird, Sea-Swallow. *Ger.* die Seeschwalbe. *Fr.* le Pierregarin.—S. cauda forficata: rectricibus duabus extimis albo nigroque dimidiatis.

(FRISCH. Tab. 119.)

In all the Northern parts of the World.

70. *COLYMBUS*. Rostrum edentulum, subulatum, rectum, acuminatum, pedes compedes.

1. *Grylle*. The Sea-Turtle. *Ger.* die Grönländische Taube.—C. pedibus palmatis tridactylis, corpore atro, rectricibus alarum albis.

(FRISCH. Tab. 185.)

Likewise in all the most Northern parts of the Earth.

2. *Troile*. The Guillemot. *Ger.* die Lumer. *Fr.* le Guillemot.—C. pedibus palmatis tridactylis, corpore fusco, pectore abdomineque niveo, remigibus secundariis extremo apice albis.

(FRISCH. Tab. 185.)

On the Sea-coasts of the Northern World.

3. *Urinator*. The Grebe. *Fr.* La Grébe.—C. capite lævi, palpebra inferiore lutea, macula alarum alba.

(EDWARDS. Tab. 306. fig. 2.)

In the hotter parts of Europe. The silver-white down on its abdomen, as well as that of the *C. cristatus*, is employed for making muffs, trimmings, &c.

71. *LARUS*. Gull. *Ger.* Möwe. *Fr.* Mouette. Rostrum edentulum, rectum, cultratum, apice subadunco. Mandibula inferiore infra apicem gibba.

Mostly on the coasts of the North World, but also in the South Seas, and often in large flocks.

1. *Tridactylus*. The Tarrock. *Ger.* die weisse Möwe.—L. albicans, dorso canescente, rectricum apicibus, excepto extremo, nigris, pedibus tridactylis.

(BRISSEAU. T. 6. Tab. 17. fig. 2.)

On the North Sea.

72. *PLUVIUS*. Rostrum rectum, acuminatum, denticulatum. Facies tecta, pedes palmati omnibus digitis connexis.

1. *Anhinga*. The Darter.—P. ventre albo.

(WILLOUGHBY. Tab. 72.)

In Brazil, &c. In the body as large as a duck, but with a very long neck, which the animal can roll up spirally, and by that means dart its head at the fish it wishes to seize.

73. *PHAETHON*. Rostrum cultratum, rectum, acuminatum, fauce pone rostrum hiant. Digitus posticus antrorsum versus.

1. *Æthereus*. The Tropic-Bird. *Ger.* der Tropikvogel. *Fr.* la Paille-en-queue.—P. rectricibus duabus longissimis, rostro serrato, pedibus æquilibris : digito postico connexo.

(BRISSON. Vol. VI. Tab. 42. fig. 1.)

On the open seas between the Tropics. Lives chiefly on the Flying-fish.

74. *PROCELLARIA*. Rostrum edentulum, subcompressum : mandibulis æqualibus, superiore apice adunco ; inferiore apice compresso-canaliculato. Pedes ungue postico sessili, absque digito.

1. *Pelagica*. The stormy Petrel, Mother Carey's Chicken. *Ger.* der Sturmvogel. *Fr.* le Petrel.—P. nigra, uropygio albo.

(LINNE *Fauna Suecica*. Tab. 2. fig. 143.)

As well in the Northern as the Southern Ocean. It is found in the open seas at a distance from land, and seamen consider its approach to their vessels a sign of a coming storm. The inhabitants of the Faroe Islands use them as lamps : they pass a wick through their bodies, which, when lighted, burns a long time, from the quantity of fat they contain.

75. *DIOMEDEA*. Rostrum rectum : maxilla superiore apice adunca ; inferiore truncata.

1. *Exulans*. The Albatross. *Ger.* der Albatros. *Fr.* l'Albatrosse.—D. alis pennatis longissimis, pedibus æquilibris tridactylis.

(EDWARDS. Tab. 88.)

Of the size of a Swan, and when the wings are expanded, measures eleven feet across. It is met with 500 German miles from land, but seldom flies more than ten or twenty feet above the surface of the sea. The Flying-Fish forms its principal food*.

76. *PELECANUS*. Rostrum rectum : apice adunco, un-

* See PENNANT'S *Arctic Zoology*, Vol. II. p. 507.

guiculato ; pedes æquibres ; digitis omnibus quatuor simul palmatis.

(a) Rostro edentulo.

1. *Onocrotalus*. The Pelican.—*P. gula saccata*.

(A Plate by J. E. RIDINGER, 1740.)

In the warmer parts of all five divisions of the World, unless the American Pelican be specifically distinct. It has its Greek name from its ass-like voice, and its German (*Kropfgans*) from the enormous bag-like crop hanging from the lower mandible, and so extensible as to be capable of containing full twenty pounds of water.

2. *Aquilus*. The Man of War-Bird. *Ger.* die Fregatte. *Fr.* le Tailleur.—*P. alis amplissimis, cauda fortificata, corpore nigro, rostro rubro, orbitis nigris*.

(EDWARDS. Tab. 309.)

It has much similarity to the Albatross in its form and mode of life ; the wings are still longer, measuring fourteen feet when expanded, and giving it a remarkable appearance when flying.

3. *Carbo*. The Cormorant. *Ger.* die Scharbe. *Fr.* le Cormorant.—*P. cauda rotundata, corpore nigro, rostro edentulo, capite subcristato*.

(FRISCH. Tab. 187.)

In all five parts of the World. Is very noxious to fish. It occasionally increases in a few years to many thousands, on coasts where it was previously unknown.

A very similar species (*Pelecanus sinensis*) is employed in China for taking fish.

(*Abbild. Nat. Hist. Gegenst.* Tab. 25.)

(b) Rostro serrato.

4. *Bassanus*. The Gannet. Soland Goose. *Ger.* die Rothgans. *Fr.* le Fou de Bassan.—*P. cauda cuneiformi, corpore albo, rostro remigibusque primoribus nigris, facie cærulea*.

(BRISSEAU. T. 6. Tab. 44.)

In great numbers in the North of Europe and America, particularly the Scottish Islands, from one of which (Bass*) it has its name. It is the principal food of the poor Islanders of St. Kilda, whose women wear the skin instead of shoes, which only last about five days, but are immediately replaced by others †.

* HARVEY *De Generat. Animal.* p. 30.

† See MART. MARTIN'S *Voyage to St. Kilda, the remotest of all the Hebrides*. 8vo. London, 1698.

77. *ANAS*. Rostrum lamelloso-dentatum, convexum, obtusum ; lingua ciliata, obtusa.

1. *Olor*. The Swan. *Ger.* der Schwan. *Fr.* le Cygne.—*A.* rostro semicylindrico atro, cera nigra, corpore albo.

(FRISCH. Tab. 152.)

In the North of the Old World : lives on frogs, aquatic weeds, &c. This, the mute or tame Swan, must be distinguished from the wild one.—*A. cygnus*, with a yellow membrane at the root of the bill, and a very long contorted trachea. The latter has a clear far-sounding voice, by no means disagreeable.

The black Swan, with white pinion feathers (*A. nigra*), is found in the fifth part of the World, at Botany-Bay, as well as on the West coast, where this beautiful animal was seen and described in 1697*.

2. *Cygnoides*. The Chinese Goose. *Ger.* die Spanische Gans. *Fr.* l'Oie de Guinée.—*A.* rostro semicylindrico ; cera gibbosa, palpebris tumidis.

(FRISCH. Tab. 153, 154.)

In Guinea, at the Cape, in Siberia, China, and, as it seems, also in the Sandwich Islands. There are several Varieties.

3. *Anser*. The Goose. *Ger.* die Gans. *Fr.* l'Oye.—*A.* rostro semicylindrico, corpore supra cinereo, subtus pallidiore, collo striato.

Wild in almost all five parts of the World. Has the most rapid growth of any warm-blooded animal. Among the tame ones, the male is very commonly snow-white, but the female scarcely ever.

4. *Canadensis*. The Hudson's-Bay Goose.—*A.* cinerea, capite colloque nigris, genis gulaque albis.

(EDWARDS. Tab. 151.)

In the coldest parts of North America. Its down is much prized for beds. It also affords excellent quills.

5. *Bernicla*. The Barnacle-Goose. *Ger.* die Baumgans.—*A.* fusca, capite collo pectoreque nigris, collari albo.

(FRISCH. Tab. 156.)

In the coldest countries of the Northern World. It comes to pass the Winter in Scotland and other milder spots. Among others, it lives on the Barnacle (*Lepas anatifera*), and hence arose the singular fable that it was produced, not from an egg, but from a shell, &c. A similar popular fable also formerly

* See VALENTYN'S *Oost Indien*, 3. D. 2 St. p. 69. Tab. D.

prevailed of a connected Species, *Anas erythropus*, of a grey colour with a white forehead, (FRISCH. Tab. 198.) which, therefore, is by many ornithologists called *Bernicla*.

6. *Mollissima*. The Eider-duck. *Ger.* der Eidervogel. *Fr.* l'Oie à Duvet.—A. rostro cylindrico, cera postice bifida, rugosa.

(BRUNNICH'S *Nat. Hist. des Eidervogels*. Tab. 1, &c.)

In the Northern World, and particularly numerous in Iceland and Greenland. Its flesh and eggs are very well flavoured. Its skin, which is used for lining clothes, and the well known Eider-down, are of great value.

7. *Boschas*. The Duck. *Ger.* die Ente. *Fr.* le Canard.—A. rectricibus intermediis (maris) recurvatis, rostro recto.

(FRISCH. Tab. 158, &c.)

The wild Duck is found in almost the whole of the Northern World, often in very beautiful varieties. The tame (*A. domestica*.) appears to have a great tendency to unnatural copulation, so that the Drake will tread the common fowl, and the Duck run after, and endeavour to excite, the Turkey-cock.

8. *Clypeata*. The Shoveler. *Ger.* die Löffelente. *Fr.* le Souchet.—A. rostro extremo dilatato rotundato; ungue incurvo.

(FRISCH. Tab. 161, &c.)

A native of nearly the same countries with the last Species. The inner edges of the bill are furnished with horny bristles almost like whalebone.

78. *Mergus*. Rostrum denticulatum, subulato-cylindricum, apice adunco.

1. *Merganser*. The Goosander. *Ger.* der Kneifer. *Fr.* l'Harle.—M. crista longitudinali erectiuscula: pectore albido immaculato, rectricibus cinereis, scapo nigricante.

(FRISCH. Tab. 190.)

In the whole of the Northern World. Together with other Species of this Genus, injurious to fish ponds, particularly at the time of spawning.

79. *Alca*. Rostrum edentulum, breve, compressum, convexum, transverse sulcatum: mandibula inferior ante basin gibba.

The whole genus is found on the coasts and cliffs of the Northern World.

1. *Arctica*. The Puffin. *Ger.* der Papagey-Taucher. *Fr.* le Macareux.—A. rostro compresso-ancipiti, sulcato sulcis 4,

oculorum orbita temporibusque albis, palpebra superiore mucronata.

Makes its nest in hollows in the ground, or in burrows, which it scratches itself.

80. *APTENODYTES*. Rostrum compressiusculum, subcultratum, longitudinaliter oblique sulcatum : mandibula inferior apice truncato : alæ impennes, pinniformes.

Their smooth glossy plumage, their fin-like, scaly wings, and their almost perpendicular carriage render the appearance of these animals very singular. The different Species are natives of the Southern Coasts and Islands of Africa and America, as well as others about New Holland, New Guinea, and New Zealand *. They are occasionally found in vast numbers together.

1. *Chrysocome*. The Crested Penguin.—A. rostro rufo-fusco, pedibus flavescentibus, crista frontali atra erecta, auriculari deflexa flava.

(*Abbild. Nat. Hist. Gegenst.* Tab. 46.)

On the Falkland Islands, New Holland, &c.

2. *Demersa*. The Black-footed Penguin.—A. rostro pedibusque nigris, superciliis fasciaque pectoralis albis.

(*EDWARDS.* Tab. 94.)

In numbers at the Cape of Good Hope, &c.

* J. R. FORSTER. *Hist. Aptenodytæ in Comment. Soc. Sc. Gött.* 1780.—Vol. III. page 181, &c.

SECT. VI.

OF AMPHIBIA.

§ 81. Mammifera and Birds are distinguished from Amphibia and Fishes, by the *warmth* and the greater *quantity* of their blood. (§ 23 and 40.)

§ 82. Amphibia, however, resemble Mammifera, and differ from Fishes, in so far as they breathe with *lungs*; although these are of a much looser texture, and their respiration much more indeterminate, and less regular than in the two Classes of warm-blooded animals. They are also capable of living much longer without respiring, or in a vacuum, (as for instance, Toads in cavities within trees or blocks of stone;) they can even endure for a time an atmosphere of carbonic acid gas, and exposure to the extremes of heat and cold; for example there are undoubted proofs of Newts and Frogs having lived in the stomach and intestines of human beings, or that have recovered, after having been frozen perfectly hard.

§ 83. And as Amphibia are provided with lungs, they are also capable of uttering sounds; although some, as the true Salamander, the Green Lizard, the Blind-worm, appear to be altogether mute.

§ 84. With regard to *form*, it is, in the Amphibia at large, of two kinds; either they have four feet, as Tortoises, Frogs, Lizards, &c.; or, as in Serpents, they have a long cylindrical body, without any external organs of motion.

§ 85. The external coverings are in the Amphibia more various than in warm-blooded animals. Some are protected by a bony shell; others have horny rings, or numerous small plates or scales; and others have a bare skin protected only by slime. The greater number change their coverings from time to time. Many, as the Tree-frog, and various Lizards, but particularly the Cameleon, change colour suddenly.

§ 86. Most Amphibia, as the name indicates, are adapted for living in water as well as on land. Many seek their prey, &c.,

voluntarily in both ; others, on the contrary, pass either a certain period of their life, or of each year, in one of the two. Lastly, there are many which are suited only for living on land or in water, but not in both.

§ 87. Many Amphibia, especially among Tortoises and Serpents, live on various kinds of food : others, on the contrary, as the Tree-frog, Cameleon, &c., are very precise in the choice of their food ; attacking, for instance, only some few species of Insects. Many, when in a state of captivity, do not take any food, and can fast for an astonishing length of time : I myself have often kept Salamanders for eight months together without food, and yet without their appearing materially reduced : as to Tortoises, it is known that they can exist full a year and a half without eating.

§ 88. The remarkable facility and strength of the *power of reproduction* in Amphibia (§ 19.) depends, if I am not mistaken, on the before mentioned force of their nerves, and on the comparatively small size of the brain ; (§ 29.) as a consequence of which, the former (the nerves,) are less dependent on the latter (the brain) ; the whole machine has less mobility, presents fewer indications of sympathy (*consensus*), and the whole life is more simple, and more purely vegetative than in warm-blooded animals ; whilst, on the other hand, the separate parts are endowed with a greater share of peculiar and independent vital power : and consequently, from this peculiar and independent vitality of individual parts, a stimulus applied to one part, or one system of parts, does not, as in warm-blooded animals, excite others by sympathy (*consensus*). We thus have an explanation of the tenacity of life in animals of this class (Frogs are known to leap about after the heart has been torn out, and Tortoises to live for months after the brain has been removed,) : and a similar explanation will apply to the long continued power of motion, in parts of Amphibia when separated from their bodies ; as, for example, the tails of Newts, Blind-worms, &c *.

§ 89. In many Amphibia, particularly Serpents, their *venom* serves as a weapon and means of defence ; in Salamanders, the milky slime which they exude when necessary ; and in

* I have investigated this subject more fully in my *Specimen Physiol. Comparatæ inter animantia calidi et frigidi sanguinis*—in *Comment. Soc. Reg. Scient. Götting. Vol. VIII.*

many others, as Serpents, Toads, Lizards, the peculiar odour that they diffuse.

§ 90. The *external* senses in the greater number of Amphibia do not appear to be very acute. Of the internal, memory is in many very remarkable; for there are instances in which Toads, and even Crocodiles, have become tame, and learned to know their benefactors; whilst it is well known that many Serpents are capable of being taught a variety of tricks. On the other hand, there are in this class of animals but few traces of *constructive instinct*. (§ 36.)

§ 91. But few Amphibia appear to require daily sleep; but, on the other hand, nearly all become torpid during the Winter months; and that sometimes singly; at others, as is the case with the Frogs and Salamanders of Europe, in heaps together. Even these, however, can easily dispense with this Winter sleep, and continue awake the whole year through, when kept in our chambers.

§ 92. The mode of propagation of Amphibia is generally remarkable. The sexual impulse is in many so violent, that Frogs, for instance, have been seen, in defect of females, to leap on male Frogs, or on Toads, or even on the dead female. In most Frogs and Sea-Tortoises, the act of copulation lasts for several days, or even weeks. Vipers, in copulating, entwine the posterior parts of their bodies very closely together, and by bending their necks, dart their tongues at one another. Salamanders, on the contrary, do not embrace, but the male swims about the female, and sprinkles the eggs that she lays with his semen.

§ 93. Amphibia are, with few exceptions, *oviparous*. Many, however, particularly among Serpents, do not deposit the egg until such time as the young animal contained in it is nearly perfect. The *Pipa* hatches its eggs on its back.

Remark. A Salamander, which I kept from the end of the Summer, at least four entire months, perfectly isolated in a glass vessel, about the beginning of the next year, unexpectedly produced thirty-four young ones within a few days: hence we may conclude that a previous impregnation retains its efficacy much longer even than in the common fowl.

§ 94. Frogs and Lizards, which are hatched in water, do not enter the world in their perfect form, but as *larvæ*, and must undergo a kind of metamorphosis before they attain their

destined form, and the use of all their limbs. The young Frogs, for instance (Gyrini, *Ang.* Tadpoles. *Ger.* Kaulquappen. *Fr.* Têtards.), have not originally any feet, but, instead, a long rudder-like tail; so also, the young Salamander, a kind of gills (Bronchiæ, or Appendices fimbriatæ of SWAMMERDAM), on each side of the neck, with a kind of sucking-tube on the under lip; parts which are clearly destined only for the larva state of the young animal, and disappear with its increasing growth.

Remark. Two animals, as yet but imperfectly known, which have a general resemblance to Lizards, but which cannot be easily classed systematically; (one, the *Proteus anguinus*, found in the subterraneous lakes of Carniola; the other, the *Siren lacertina*, from the lakes of Carolina;) present the anomaly of lungs, together with gills, such as in the reptiles already mentioned, are found only in the larva state. For the *Proteus*—which has three toes on the fore-feet; two on the hinder; no opening of the eyelids, but yet rudiments of an eyeball under the skin—see Professor SCHREIBER (to whom I am indebted for an excellent specimen of this rare and singular animal), in the *Phil. Trans.* for 1801; P. CONFIGLIACHI e M. RUSCONI del *Proteo anguino*. Pavia, 1819. 4to. and M. TREVIRANUS, senior, in the *Comment Soc. Scient. Götting. recent.* Vol. IV. For the *Siren*, see ELLIS and J. HUNTER, in *Phil. Trans.* Vol. LVI.; and for both, M. CUVIER in his *Recherches anatomiques sur les Reptiles regardés encore comme douteux*. Paris, 1807. 4to.

§ 95. The Amphibia are slow in growth; so that, for example, the Frogs of these climates are incapable of producing until their fourth year; and yet reach what must be considered in proportion to the late period of puberty, the considerable age of from twelve to sixteen years. On the other hand, it is known that Tortoises, even in captivity, have lived upwards of 100 years; so that by analogy, it may be supposed that Crocodiles, and the large Serpents reach a still more advanced age.

§ 96. The utility of Amphibia to the human race is but limited; in many places, however, it is pretty considerable. Tortoises and their eggs afford food, as do also various Frogs, and Lizards. Tortoises also furnish the well known shell and oil. The Alligator's skin, when dressed, makes beautiful saddles, &c.

§ 97. Many monstrous animals of this Class are noxious from their bulk, as Crocodiles, Water-snakes, &c.; others, as

Serpents, from their venom, which is more dangerously active than in any other class of animals.

§ 98. The whole class is divided into two Orders only :—

I. REPTILES. Amphibia with four feet. (The *quadripeda ovipara* of the old naturalists.) Tortoises, Frogs, Lizards.

II. SERPENTES. Serpents without any external organs of motion (§ 84.)

Authorities for the Natural History of this Class.

ALB. SEBA. *Rerum naturalium Thesaurus*. Amst. 1734. 1765. Vol. IV. fol. (the two first volumes.)

JO. NIC. LAURENTI. *Synopsis reptilium emendata*. Vindob. 1786. 8vo.

C. de LACEPEDE. *Histoire naturelle des quadrupèdes ovipares et des serpents*. Paris, 1788. 2 Vols. 4to. and translated into German, with remarks and additions by M. BECHSTEIN. Weimar, 1800. 5 Th. 8vo.

G. AD. SUCKOW. *Anfangsgründe der N. G. der Thiere*. 3 Th. Leipzig, 1798. 8vo.

J. GOTT. SCHNEIDER. *Historiæ amphibiorum naturalis et literariæ*, Fasc. I. II. Jen. 1799. 1801. 8vo.

FR. TIEDEMANN, M. OPPEL, und JOS. LIBOSCHITZ. *Natur-Geschichte der Amphibien*. Heidelberg, seit 1817. fol.

B. MERREM. *Tentamen Systematis Amphibiorum*. Marburg, 1820. 8vo.

I. REPTILES.

All the animals of this Order possess (at least when they have arrived at their perfect state,) four feet, the toes of which are, according to their mode of life, either separate, (*pedes digitati*), connected by membranes (*palmati*), or confounded with one another in the form of a fin (*pinnati*.)

1. TESTUDO. Turtle. Tortoise. *Ger.* Schildkröte. *Fr.* Tortue. *Span.* Galapago.—Corpus testa obtectum, cauda (plerisque) brevis, os mandibulis nudis * edentulis.

Most Tortoises are covered with a firm long shell, the upper part of which is connected with the spine and ribs, and is covered by the broad horny plates, which in many species are

* J. G. SCHNEIDER'S *N. G. der Schildkröten*. Leipzig, 1783. 8vo. J. D. SCHOEPPF. *Historia testudinum iconibus illustrata*. Erlang. 1792. 4to.

so firm and of such beautiful colours as to be employed for various purposes of art. There are usually thirteen such plates in the middle, and twenty-four round the edges. The under shell, covering the belly, is somewhat smaller than the upper, with openings for the head, the tail, and the feet.—The very peculiar and distinct form of this consequently isolated Genus forms a very strong proof of the non-existence of the supposed gradation of objects in nature.

1. *Membranacea*. T. pedibus palmatis, unguiculis tribus, testa orbiculari ovata, membranacea, grisea, striata scabra.

(SCHNEIDER, l. c. Tab. 1.)

In Guiana.

2. *Imbricata*. The Hawks-bill Turtle. Ger. die Carette. Fr. le Caret.—T. pedibus pinniformibus, testa cordata subcarinata, margine serrato: scutellis imbricatis latiusculis, cauda squamata.

(BRUCE'S *Travels to the Source of the Nile*. App. pl. 42.)

In both Indies: also in the Red Sea. Gives the best Tortoise-shell*.

3. *Mydas*. The Green Turtle. Ger. die Grüne Schildkröte. Fr. la Tortue franche, (*viridis* SCHNEIDER.)—T. pedibus pinniformibus, marginibus maxillarum dentatis, testa ovata.

(SCHÖPFF. Tab. 17. fig. 2.)

This Species sometimes weighs eight hundred weight. It has its common name from the pale olive green colour of the shell, and the still more remarkable green colour of its delicately flavoured fat: It feeds solely on sea weeds, whence its flesh is so well tasted, without being in the least oily.

4. *Orbicularis*. The common Tortoise. (*Europea*. SCHNEIDER.)—T. pedibus palmatis, testa orbiculata planiuscula.

In the temperate parts of Europe.

5. *Græca*. T. pedibus subdigitatis, testa postice gibba: margine laterali obtussissimo, scutellis planiusculis.

(*Abbild. Nat. Hist. Gegenst.* Tab. 66.)

In the South of Europe and North of Africa.

6. *Geometrica*.—T. pedibus posticus palmatis, testæ scutellis elevatis truncatis.

(SCHÖPFF. Tab. 10.)

In the East Indies and at the Cape. About as large as the palm

* BECKMAN'S *Vorbereitung zur Waarenkunde*. 1 Th. S. 63. u. f.

of the hand. Its high arched shell, very regularly marked with black and yellow, gives it a very pleasing appearance.

2. *RANA*. Frog. Toad. *Ger.* Frosch Kröte. *Fr.* Grenouille.

Crapaud.—Corpus nudum pedibus quatuor posticis longioribus *.

1. *Pipa*.—*R.* corpore plano, rostro spathiformi, digitis anticis muticis quadridentatis, posticis unguiculatis.

(*Abbild. Nat. Hist. Gegenst. Tab.* 36.)

In the Lakes of Guiana. Is remarkable for the singular and anomalous manner in which the mother hatches the young ones. The male places the spawn, which the female lays in the usual manner, on her back, and then impregnates it with his semen. The ova then grow, as it were, in the substance of the skin of the mother, until at the end of nearly three months, the Tadpoles †, which at first have tails, have arrived at their full period, and the tail having been replaced by four feet, they quit the mother's back.

2. *Cornuta*. The Horned Toad.—*R.* palpebris conicis.

(*SEBA. Vol. I. Tab.* 72. fig. 1, 2.)

In Virginia; its large bull-eyes and monstrous horn-like eyelids give it a frightful appearance.

3. *Ocellata*. The Bull-Frog.—*R.* auribus ocellatis, pedibus muticis.

(*CATESBY. Vol. II. Tab.* 72.)

In North America. Almost as large as a Guinea-pig. It has its English name from its loud voice.

4. *Paradoxa*. (*Rana piscis*).—*R.* femoribus postice oblique striatis.

(*SEBA. Vol. I. Tab.* 78.)

In South America. The Larva (§ 95.) is almost a span long; is then much larger than the perfectly formed animal, and has given rise to the fable of Frogs which change into fishes. The animal retains its tail for some time after the four legs have acquired their perfect form and size.

5. *Bufo*. The Toad. *Ger.* die Kröte. *Fr.* le Crapaud.—*R.* corpore ventricosso verrucoso lurido fuscoque.

(*ROSEL. Tab.* 20, 21.)

There is no truth in the assertion that its urine is poisonous.

* For the species of these climates see ROSEL's *Nat. Hist. der Frösche hiesigen Landes Nürnberg*, 1758. gr. fol.

† CAMPER, in *Comment. Soc. Reg. Scient. Götting.* Vol. IX. p. 129, &c.

On the other hand, it is indisputable that living Toads have been found in sawing through blocks of stone, trees, &c.

6. *Bombina*. Ger. die Feuerkröte.—R. corpore verrucoso, abdomine aurantio-cæsius maculato, pupilla triquetra.

(ROSEL. Tab. 22.)

The belly beautifully marbled with blue and yellow. It leaps almost like a frog.

7. *Portentosa*. (*Bufo calamita*. LAURENT.) Ger. die Haus-Unke.—R. verrucosa, linea dorsali flava, lateralibus rufescentibus.

(ROSEL. Tab. 24.)

It lives in damp cellars, holes on the banks of rivers, &c., and seldom shews itself: it makes a dull peculiar noise, which has given rise to a variety of sayings.

8. *Temporaria*. The common Frog.—R. subfusca dorso planiusculo subangulato.

(ROSEL. Tab. 1-8.)

Lives in grass, among bushes, &c., whence the young ones come out in vast numbers after warm summer-showers, a circumstance which has given rise to the old tales of its raining frogs.

9. *Esculenta*. The Edible Frog. Ger. der Grüne Wasserfrosch.—R. viridis, corpore angulato, dorso transverse gibbo, abdomine marginato.

(ROSEL. Tab. 13-16.)

In ponds and marshes. The males croak very loud, particularly on fine evenings, and in so doing, expand two large bladders placed at the angles of the mouth. They are bold and cunning, and destroy mice, sparrows, young ducks, trout, &c., and can even master pike. In this and the last species, the male is provided during the season of copulation, with black warty balls on the thumbs of the fore-feet, by means of which it embraces the body of the female very firmly.

10. *Arborea*. The Tree-Frog. Ger. der Laubfrosch. Fr. le Graisset. (*Calamites*. Hyla.)—R. corpore lævi, subtus granulato, pedibus fissis, apicibus digitorum lenticulatis.

(ROSEL. Tab. 9-12.)

In almost the whole of Europe, England excepted, also in America. The clammy slime with which it is covered, like serpents, serves to support it among the leaves of the trees in which it lives. The adult males, which are recognizable by their brown throats, have a loud voice, and are heard

when the weather is about to change, but particularly during the season of copulation. In croaking, they expand the throat like a large bladder.

3. DRACO *. Corpus tetrapodum caudatum, alatum.

1. *Volans*. The Dragon. Ger. die Fliegende Eidechse.—D. brachiis ab ala distinctis.

(Abbild. Nat. Hist. Gegenst. Tab. 98.)

In the East Indies and Africa.

4. LACERTA. Lizard. Ger. Eidechse. Fr. Lézard.—Corpus elongatum, pedibus quatuor æqualibus.

1. *Crocodylus*. (*Crocodylus vulgaris*. CUVIER.) The Crocodile.—L. rostro æquali, scutis nuchæ 6, squamis dorsi quadratis, sex-fariam positis, pedibus posticis palmatis.

(Abbild. Nat. Hist. Gegenst. Tab. 26, 27.)

Very common in the great rivers of Africa, particularly the Upper Nile and the Niger. It is the largest animal inhabiting fresh water, attaining to full thirty feet† in length, notwithstanding which, its eggs are scarcely as large as a goose's. When full grown, it attacks men and other large animals. When taken young, it may be tamed‡.

2. *Alligator*. The Alligator. Cayman. (*Crocodylus sclerops*. CUV.)—L. porca transversa inter orbitas, nucha fasciis osseis 4 cataphracta, pedibus posticis semipalmatis.

(SEBA. Vol. I. Tab. 104. fig. 10.)

In the central parts of America. The body and tail are more round and smooth than in the true Crocodile; it is also smaller and has smaller eggs. Like it, however, it has five toes on the fore-feet, and four on the hinder, of which only the three inner ones are provided with claws. The skins of this species are excellently tanned in the Brazils.

3. *Gangetica*. The Gavial.—L. mandibulis elongatis subcylindricis, pedibus posticis palmatis.

(EDWARDS in *Phil. Trans.* Vol. XLIX.)

Principally in the Ganges.

4. *Monitor*. Fr. La Sauve-garde.—L. cauda carinata, corpore mutico squamis marginatis, maculis ocellatis.

(SEBA. Vol. I. Tab. 94. fig. 1, 2, 3.)

* FR. TIEDEMANN. *Anat. und N. G. des Drachen*. Nürnberg, 1811. 4to.

† NORDEN says fifty.—*Voyage d'Egypte*. p. 165.

‡ For the different species of Crocodile, see M. CUVIER in *Annales du Museum d'Histoire Naturelle*. T. 10. 1807.—And M. G. St. HILAIRE in the same work, on two species of Crocodile in the Nile.

In both Indies. Is about three feet long, and very regularly spotted with black and white. It has obtained its name, because it is said to keep in company with the Crocodile, and to warn by its whistling noise, of the proximity of its formidable associate.

5. *Iguana*. The Guana. *Ger.* der Leguan. *Fr.* l'Iguane.—*L.* cauda tereti longa, sutura dorsali dentata, crista gulæ denticulata.

(SEBA. Vol. I. Tab. 95. Tab. 98. fig. 1.)

In the West Indies. An active animal, with very well flavoured flesh and eggs.

6. *Chamæleon*.—*L.* cauda prehensili, digitis duobus tribusque coadunatis.

(J. F. MILLER. Fasc. 2. Tab. 11.)

In the East Indies, North Africa, and Spain. It is indolent and slow in its motions, lives among trees and hedges, feeds on insects, which it very dexterously catches with its long viscous tongue, which is club-shaped, and hollowed in front. Its lungs are very large, and by expanding them, the animal can at pleasure make itself appear large or small; hence, probably, arose the saying that it feeds on air. Its eyes have this peculiarity, that they can be directed in different ways; for instance, one upwards, the other backwards, and that with great rapidity. Its natural colour is greenish grey, which, however, changes at times, particularly when it is irritated. The reflection of coloured objects, in its vicinity, on the glittering scales of the living animal, probably gave origin to the fable, that its colour is regulated by that of the bodies near which it is placed.

7. *Gecko*. (probably the true *stellio* or *saurus* of the ancients.)—*L.* cauda tereti mediocri, digitis muticis subtus lamellatis, corpore verrucoso, auribus concavis.

(SEBA. Vol. I. Tab. 109.)

In Egypt, the East Indies, the South Sea Islands, and even in some parts of Europe, as the Kingdom of Naples. It has a poisonous fluid between its scaly toes, which it communicates to the eatables over which it passes.

8. *Scincus*. (*Crocodilus terrester*.)—*L.* cauda tereti mediocri, apice compressa, digitis muticis lobato-squamosis marginatis.

(*Abbild. Nat. Hist. Gegenst.* Tab. 87.)

In Arabia Petrosa, &c.

9. *Agilis*. The common Lizard. *Ger.* die Grüne Eidechse. *Fr.* le Lézard gris.—*L. cauda verticillata longiuscula, squamis acutis, collari subtus squamis constricto.*

(ROSEL. *Geschichte der Frösche*. Titelpupf.)

In the warmer parts of Europe, and, as it seems, also in both Indies, and the South Sea Islands. Its eggs shine for a time in the dark.

10. *Lacustris*. The Newt. *Ger.* der Wasser-Molch.—*L. nigra, dorso lateribusque verrucosis, abdomine flavo, nigro maculato.*

(LAURENT. Tab. 2. fig. 4.)

In Spring, the males have a projecting notched membrane, extending along the back, from the head to the tail. I have already spoken of its surprising powers of reproduction.

11. *Salamandra*. The Salamander. *Ger.* die Molle. *Fr.* le Sourd.—*L. cauda tereti brevi, pedibus muticis, corpore flavo nigroque vario, nudo, poroso.*

(ROSEL. *Geschichte der Frösche*. Titelpupf.)

A span long, as thick as a man's thumb, and spotted with black and yellow. It is not true that it is poisonous, that it can live in fire, &c.

II. SERPENTES.

Serpents * have not any external organs of motion, but merely a long cylindrical body, which they move in an undulating manner, and which is covered with scales, plates, or rings. Many live in water, in which they can easily swim, on account of their very long and bladder-like lungs; others on the ground; and others principally on trees. Their eggs are commonly connected together; their jaws are not, as in other animals, articulated with each other, but are unsuited for chewing, since they admit of being very widely separated, so that serpents are enabled to swallow entire animals much larger than themselves. Their slender, and, for the most part, cloven tongue, serves them for tasting †. Many are provided with an active venom, contained in little bags on the front of the upper jaw ‡, secreted by particular glands, and conveyed

* BLAS. MERREM *Beiträge zur Geschichte der Amphibien*.—Duisb. 4to. PATR. RUSSEL'S *Account of Indian Serpents, together with Experiments on their several poisons*. London, 1796. fol.

† AUG. HELLMANN *ueber den Tastsinn der Schlangen*. Göttingen, 1817.

‡ The number of known venomous Species, compared to those which are not so, is reckoned as one to six.

into the wound made in biting, by means of isolated teeth, which are tubular, with a longitudinal opening at the point (*Abbild. Nat. Hist. Gegenst. Tab. 37. fig. 1.*) These poison-teeth, placed on the anterior edge of the upper jaw, with the corresponding increase in the size of the latter, afford the most certain means of distinguishing the venomous serpents from those which are not so, as in the latter, the whole of the outer edge of the upper jaw is furnished with teeth even to the very back part. (*Abbild. Nat. Hist. Gegenst. Tab. 37. fig. 2.*) Serpents of all kinds agree in having a double row of small teeth in the palate.

Among the other characters of distinction between the serpents that are, and those that are not venomous, (which, however, are not altogether free from exceptions) are, 1st, the broader and heart-shaped head of the former, with small flat scales, instead of a single plate; 2d, the keel-shaped ridge on the back; and 3d, the shorter tail, which measures less than one-fifth of the animal. (See Dr. GRAY, in *Phil. Trans. Vol. LXXIX. p. 1.*)

5. *Crotalus*. Rattle-snake. *Ger.* Klapperschlange. *Fr.* Serpent à sonnettes.—Scuta abdominalia. Scuta squamæque sub-caudales. *Crepitaculum* terminale caudæ.

1. *Horridus* ♂.*—C. Scutis 167, scutellis 23.

(SEBA. Vol. II. Tab. 95. fig. 1.)

Principally in the warmer parts of North America: grows to the length of six feet, and the thickness of a man's arm. The Species of this Genus are distinguished from all other serpents, and indeed from all animals in the Creation, by the singular, horny, articulated rattle at the end of the tail. The number of pieces in this wonderful and anomalous organ, increases with the age of the animal, and in old ones, may amount to forty. We are assured by credible eye-witnesses, that squirrels, small birds, &c., fall from the trees on which they stand, as it were, spontaneously, into the throat of the Rattle-snake below†;

* *The Serpents marked thus ♂ are venomous.*

† As the Rattle-snake is very inactive, and cannot climb up trees, MEAD's supposition is by no means improbable, that the Rattle peculiar to them, may serve to bring birds, &c. within their reach, from the effects of the fear its sound produces: in the same manner that the horns of the *Cerastes* were formerly imagined, and probably not without justice, to be employed.—Major GARDNER, a correct and faithful observer, who had long lived in East Florida, affirms, that the young Indians of that country were accustomed to imitate the noise of this Serpent, for the purpose of taking

the circumstance is, however, not by any means confined to this Genus, as it has been remarked in many other serpents of both the Old and New Worlds. Rattle-snakes are eaten by hogs and birds of prey. They may also be tamed, and rendered docile.

6. BOA. Scuta abdominalia et subcaudalia.

1. *Constrictor*. Ger. die Riesenschlange. Fr. le Devin.—B. scutis 240, scutellis 60.

(MERREM. 2 Heft. Tab. 1.)

In the East Indies and Africa. According to Adanson's assurances, is from forty to fifty feet long. It breaks the ribs and other bones of living Antelopes, &c., which it covers with a jelly-like saliva, and swallows. It is, however, easily rendered docile, and, together with the Cobra de Capello, is taught a variety of tricks by the Indian jugglers.—The Amaru of South America, which was worshipped by the Antis of Peru, and is thirty feet long, appears to differ but little from it. On the contrary, the Juda, considered sacred in Guinea, is a distinct species.

7. COLUBER. Scuta abdominalia, squamæ subcaudales.

1. *Vipera*.—C. scutis 118, squamis 22.

The name Viper has been applied to many serpents. This one, so named by LINNÆUS, is a native of Egypt, and is not venomous.

2. *Cerastes*. The Horned-Adder. Ger. die Gehörnte Schlange ♂.—C. tentaculis superciliaribus, scutis 145, squamis 44.

(BRUCE's *Travels to the Source of the Nile*. Append. Tab. 40.)

This Serpent, which has its name from the little horns projecting above the eyes, is a native of the same country with the last, and is undoubtedly venomous.

3. *Berus*. The Adder. Ger. die Otter. Fr. la Vipere commune ♂.—C. scutis 146, squamis 39.

(LAURENTI. Tab. 2. fig. 1.)

This Viper, formerly used in medicine, is of a brownish colour, and a native of the warmer parts of the Old World, as well as Germany and Switzerland. Its bite causes violent inflammation, but is rarely fatal. This is the Species with which Redi, and subsequently Fontana, performed so many experiments.

squirrels, &c. I have treated this subject more fully in *Voigt's Neues Magazin*. B. 1. St. 2. S. 37.—On the power of fascination in the Rattle-snake, in reference to an Essay by Dr. BARTON.

4. *Natrix*. The Ringed Snake. *Ger.* die Ringel-Natter. *Fr.* la Coleuvre à Collier.—C. scutis 170, squamis 60.

Steel-grey, with lateral white spots, particularly upon both sides of the neck. Even in Europe it has been found ten feet in length and upwards, which has given rise to the frightful tales of Dragons, &c.

5. *Coccineus*. The Red-Snake. *Ger.* die Carmoisin-Schlange. *Fr.* le Serpent écarlate.—C. scutis 175, squamis 35.

(VOIGT'S *Magazin*. 5^{ten}. B. 1^{stes}. S.—Tab. 1.)

This beautifully coloured and harmless Snake is a native of Florida and New Spain. It is as thick as a finger, and about two feet long. Along the back are about twenty large and very regular carmine-red spots with black edges, separated from each other by cross bands of a lemon-yellow colour. The young females in Florida wear it as a necklace, or twisted into their hair as an ornament.

6. *Naja*. The Cobra de Capello. *Ger.* die Brillenschlange. *Fr.* le Serpent à lunettes ♂.—C. scutis 193, squamis 60.

(RUSSEL'S *Indian Serpents*. Tab. 5, 6.)

In the East Indies. The neck is capable of being very much expanded, and is marked at the back part with a figure resembling a pair of spectacles. It is one of the most venomous snakes, but is destroyed in great numbers by the Ichneumon, and can be easily taught a variety of tricks.

8. *ANGUIS*. Squamæ abdominales et subcaudales.

1. *Fragilis*. The Blind-Worm. Slow-worm. *Ger.* die Blind-schleiche. *Fr.* l'Orvet.—A. squ. abd. 135, totidemque subcaud.

In marshy spots, old buildings, &c. When handled, it easily breaks in two, and the pieces continue to move for some hours. There are many varieties of it, often very beautifully marked.

2. *Platuros* ♂.—A. cauda compressa obtusa.

(*Abbild. Nat. Hist. Gegenst.* Tab. 28.)

In the Indian Ocean and South Seas.

9. *AMPHISBÆNA*. Annuli trunci caudæque.

1. *Fuliginosa*.—A. ann. tr. 200, caudæ 30.

(SEBA. Vol. I. Tab. 88. fig. 3, &c.)

In America.—Spotted with black and white.

10. *CÆCILIA*. Rugæ trunci caudæque. Labrum superius tentaculis 2.

1. *Tentaculata*.—C. rugis 135.

(SEBA. Vol. II. Tab. 25. fig. 2.)

Also in America. It has not any scales, but merely rings in its smooth skin, almost like an earth worm.

SECT. VII.

OF FISHES.

§ 99. Fishes are those animals which possess red cold blood, which move by means of true *fins* (with bony or cartilaginous fibres,) and which breathe by true *gills* lying deep at each side of the neck; and not, as in the larvæ of Frogs, &c., projecting beyond it.

Remark. I say *true gills* and *true fins*, in order to distinguish them from organs to a certain degree analogous in young Frogs, Salamanders, &c. (§ 94.)

§ 100. These gills (*branchiæ*), in fishes, almost perfectly supply the place of lungs. They are placed on each side behind the head, for the most part under one or more large semilunar plates, hence called *opercula branchialia*, and in most instances connected with the membrane of the gills, *membrana branchiostega*. The gills themselves are filled with innumerable very delicate vessels, and are mostly divided on each side into four layers, which somewhat resemble the beard of a quill, and which are attached at their bases to a corresponding number of little bones.

§ 101. Respiration, which fishes are nearly as incapable of dispensing with as those animals which possess lungs, is in them effected by introducing the air, which the water holds in solution, through the mouth into the gills, and then expelling it again through the branchial aperture, (*apertura branchialis*); consequently not by inspiring and expiring through the same passages, as in those animals which possess lungs.

§ 102. Not having lungs, it is evident that they cannot have any voice, although some, as *Cottus cataphractes*, *Cobitis fossilis*, &c., can make a noise.

§ 103. The form of the body in fishes, in general, is infinitely

more varied than in the two preceding classes. In most, however, the body has a vertical direction, *i.e.* is flattened at both sides, (*corpus compressum*); in some, on the contrary, as the Rays, it is horizontal and extended laterally (*corpus depressum* sive *plagioplateum*); in others, as the Eel, &c., it is more rounded; in others, prismatic or quadrangular, &c.

In all, the head and trunk are connected immediately, without being separated by a neck.

§ 104. With only a few exceptions, fishes are covered with scales; in the osseous fishes the scales are real, are formed of a peculiar substance, and in different Species present a great number of varieties in point of form, marks, and colours, which latter sometimes shine like gold and silver. On the other hand, the cartilaginous fishes, in general, are covered with several bone-like plates, hook-shaped prickles, &c.

The scales are covered externally with a kind of slime, which appears to be in a great measure excreted from small cavities, which, in most fishes, are placed in a line along each side of the body.

§ 105. The fins, the organs of motion in fishes*, in which a very great power of reproduction has been remarked, consist of their bony or cartilaginous spines or rays, connected together by a particular membrane, fastened to a bone, and set in motion by certain muscles. They are called, according to their position, the upper dorsal fins; those at the side, behind the gills, pectoral fins; those on the belly in front of the anus, abdominal fins; those behind this opening, anal fins; and lastly, those on the tail, which always have a vertical direction, caudal fins.

The Flying-fish, as they are called, have very long and stiff pectoral fins, by means of which they can raise themselves above the surface of the water, and fly for a short time.

§ 106. Another auxiliary in the motion of fishes, particularly in rising and sinking, is the swim-bladder, with which fresh-water fish in particular are supplied, and which communicates by a particular canal, (*ductus pneumaticus*) generally with the œsophagus, seldom with the stomach.

* On the Mechanism of the swimming of Fishes, as well as the flight of Birds; see A. W. ZACHARIA'S *Elemente der Luftschwimmkunst*. Wittenburg, 1807.—And on the share that their breathing by gills has in it; S. J. BRUGMAN'S *over de Middelen door welke de Vischen zich bewegen*. Amst. 1813. 4to.

§ 107. With regard to their place of abode, fishes in general are divided into sea-fish and fresh-water fish. Many can live for some time out of water, as the Eel, *Muræna*, &c. Others in hot mineral springs*.

§ 108. Most fishes, especially those of the sea, are nocturnal animals, that is, they are active during the night, and in the day remain in a state of repose. Hence the inhabitants of Islands and Coasts, who live on fish, choose the night for catching them.

§ 109. A great many Species of fish change their place of abode at certain seasons of the year. Many sea fish ascend the mouths of rivers and creeks to spawn; many, as the Herring for instance, in the North Atlantic, make extensive migrations at certain seasons of the year in incalculable numbers between the Coasts of the West of Europe, and North-East of America†.

§ 110. Fishes are in great proportion carnivorous animals, and as they have no feet with which to hold their prey, are supplied with a variety of other contrivances for mastering it. Some have long fibrous threads (*cirri*) about the mouth, for the purpose of enticing other small marine animals, as with a bait, as in the Stargazer, Frog-fish, &c. Others, as the *Chætodon rostratus*, have a kind of syringe with which they strike down insects flying over the surface of the water; others, as the three sea-fish, the Electric Ray, the *Tetrodon electricus*, and *Trichiurus indicus*, and the two fresh-water fish, the Electric Eel and *Silurus electricus*, possess a peculiar benumbing paralyzing power, &c.

§ 111. As to the external senses of fishes, smelling must in many be very acute, from the distance at which they discover a bait. Their hearing, also, is good, and they have organs similar to those of the internal ear in other red-blooded animals. Above all, however, there are many peculiarities in their eyes, numerous membranes, parts not found elsewhere, &c‡.

§ 112. From the deficiency of correct observations, little can be said decidedly on their instincts, and other mental

* SONNERAT, in ROZIER'S *Journal de Physique*. Avr., 1774. p. 256.—And BUFFON, *Supplement*, Vol. V. p. 540, &c.

† See GILPIN'S *Chart* in the *Transactions of the American Philos. Soc.* at Philadelphia, Vol. II. Tab. 5. B.

‡ See my *Manual of Comparative Anatomy*, p. 418, &c. 2d Edit.

faculties. It is known, however, that many, Trout * for example, become very docile; and that others, as old Carp, are very wary and cunning.

§ 113. As to their sleep, the observation that was made with respect to the Amphibia (§ 91.) is applicable, viz. that probably most have a Winter sleep, but only a very few a fixed daily sleep, as is said to be the case with the Gold-fish.

§ 114. Except the small number of viviparous fishes, such as the Eel, the *Blennius viviparus*, but very few actually copulate. In most instances, the female lays the unimpregnated eggs, the male coming afterwards and sprinkling them with his semen.

Advantage of this circumstance has been taken in rural economy, young fish having been procured by the artificial mixture of the ova and semen of Trout, &c †.

Remark. Among other peculiarities in the mode of generation in fishes, many, as the Lamprey, possess the organs of both sexes in perfection: whilst in others, as the Carp, anomalous instances of Hermaphrodites are found.

§ 115. The increase in the numbers of most fishes is wonderfully great, so that although the ova are in most instances proportionally much smaller than in any other class of animals, the ovaria of many are larger than the whole of the body. Thus, in the Herring, there have been counted from 20,000 to 37,000 ova; in the Carp, upwards of 200,000; in the Tench, 383,000; in the Flounder, upwards of a million.

§ 116. In some cases, the young fish have not their perfect form when they escape from the egg; but must, as in the Amphibia, (§ 94.) undergo a kind of metamorphosis by which they obtain fins, &c.

§ 117. In proportion to their size, fishes reach a very advanced age. Examples are known of Carp, Pike, &c., living 150 years. On the other hand, some small fishes, as the Stickleback, live only a few years.

§ 118. The utility of fishes to man is not very various; for the most part only as food, but in this respect of the utmost importance to a great part of the human race, who live only on this class of animals. Savage nations, as the Kamschatkadales, Bra-

* BASTER, *Opuscula subseciva*. T. 1. L. 2. p. 88.

† JACOBI, in the *Hanoverian Magazine*, 1765. p. 978, &c.

‡ *Phil. Trans.* Vol. LVII. p. 280.

zilians, &c., possess the art of preparing fish in a great variety of ways, even as a kind of flour, bread, &c. With many, as the Islanders of the Pacific Ocean, fishing forms a principal occupation, and a serious kind of study with reference to the ingenious methods and instruments which they have invented. To a great part of the cultivated world, the taking of the Herring, the Cod, Tunny, &c., is of still greater value. The oil of the Shark, Cod and Herring, is used for burning in lamps, &c. The inhabitants of the Eastern Coasts of the middle of Asia, clothe themselves with the tanned skin of the Salmon.—Many parts of other fish are employed for purposes of art, as the scales of the Bleak for making false pearls.—Shagreen is made from the skin of Sharks and Rays; isinglass from the Sturgeon, &c.

§ 119. Fishes of prey are the most noxious, particularly the Shark in the Ocean, and the Pike in fresh water. Many fishes, at least in certain spots, are poisonous, and prove fatal when eaten. Such, in particular, are certain Species of the Genus *Tetrodon*.

§ 120. The systematic classification of fishes appears to stand in need of much improvement. In the mean time they are arranged in two principal divisions, viz:—

(A.) Cartilaginous fishes (*Pisces cartilaginei*), without true bones: and

(B.) Bony fishes (*Pisces spinosi*), having bones, fishes properly so called.

The cartilaginous fishes are divided into the following two Orders, which M. de LACEPEDE has established, according to the presence or absence of the covering of the gills (*operculum*), and has divided the genera which they include accordingly:—

Order I. CHONDROPTERYGII. Without an operculum.

II. BRANCHIOSTEGI. With an operculum.

LINNÆUS has arranged the osseous, or true fishes, according to the character and position of the ventral fins: viz.

III. APODES. Without ventral fins.

IV. JUGULARES. Having the ventral in front of the pectoral fins.

V. THORACICI. Having the ventral immediately below the pectoral fins.

VI. ABDOMINALES. Having the ventral behind the pectoral fins.

On the Natural History of Fishes.

- GUIL. RONDELET *de Piscibus*. Lugdun, 1554. p. 2. 1555. fol.
 CONR. GESNER *de Piscium et aquatiliū animantium Natura*.
 Fig. 1558. folio.
 STEPH. A SCHONEVELDE *Ichthyologia*, &c. Hamburg, 1624.
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 1787. 4to.

I. CHONDROPTERYGII.

The cartilaginous fishes of this Order have no branchial operculum, and in most, the mouth is placed on the under side of the head.

1. PETROMYZON. Spiracula branchialia 7 ad latera colli.
 Fistula in nucha. Pinnæ pectorales aut ventrales nullæ.
1. *Marinus*. The Lamprey. *Ger.* die Lamprete. *Fr.* la Lamproye.—P. ore intus papilloso, pinna dorsali posteriore a cauda distincta.

(BLOCH. Tab. 77.)

In the Northern Ocean, the Mediterranean, and other seas. It

also ascends rivers twenty (German) miles or more. It is about three feet long.

2. *Fluviatilis*. The lesser Lamprey. *Ger.* die Pricke, Neunauge.—*P. pinna dorsali posteriore angulata.*

(BLOCH. Tab. 78.)

In the great rivers. Only half as large as the last Species.

2. *GASTROBRANCHUS*. *Spiracula branchialia 2 ventralia.*
Fistula in rostro. Pinnæ pectorales aut ventrales nullæ.

This obscure Genus was formerly classed among the Vermes, under the name of *Myxine*.

1. *Cæcus*. The Hag-fish. *Ger.* der Blindfisch. Schleimaal.
(*Myxine glutinosa*. LINN.)

(BLOCH. Tab. 413.)

On the Coasts of the North Atlantic. It is without eyes.

3. *RAIA* *. *Ray. Ger.* Roche. *Fr.* Raie. *Spiracula branchialia 5, subtus ad collum; corpus depressum; os sub capite.*

This Genus is remarkable for many wonderful peculiarities in its form and organization. Many Species have been dried and metamorphosed by a variety of artifices, into supposed Basilisks, &c. Many also appear to have, in some degree, contributed to the fables of Sirens, by a certain similarity of the lower part of their head to the human face†. Although they lay but one egg at a time, they increase so rapidly, that the Ocean in some spots actually swarms with them. Their eggs have a horny covering with four points, and are called Sea-mice.

1. *Torpedo*. The Electric Ray. *Ger.* der Zitterroche. *Fr.* la Torpille.—*R. tota lævis maculis dorsalibus 5 orbiculatis.*

(*Abbild. Nat. Hist. Gegenst.* Tab. 57.)

Principally in the Mediterranean. The best known of all the electric fishes. (§ 110.) It is eaten in some places.

2. *Batis*. The Skate. *Ger.* der Glattroche. *Fr.* la Raie lisse.
—*R. varia, dorso medio glabro, cauda unico aculeorum ordine.*

(BLOCH. Tab. 79.)

* On this and the two following Genera, together with the *Chimeræ*—see ED. EICHWALD *de Selachis* Aristot.—Viln., 1819. 8vo.

† As for example, the *Pesce donna* of the Capucin CAVAZZI, in his *Descrizione di Congo*, &c. p. 52.

In the European Seas. Weighs as much as two hundred weight, and is very well flavoured.

3. *Pastinaca*. The Sting-ray. *Ger.* der Stachel-roche. *Fr.* le Pastenague.—*R.* Corpore glabro, aculeo longo antierius serrato in cauda, et dorso apterygio.

(BLOCH. Tab. 82.)

In many parts of the Ocean. The sting of its tail is not venomous, but is used as a weapon by the animal, and even by some savage nations.

4. *SQUALUS*. Shark. *Ger.* Hay. *Fr.* Chien de Mer.—*Spiracula branchialia* 5 ad latera colli. *Corpus oblongum teretiusculum*. *Os* in inferiore capitis parte.

1. *Acanthias*. *Ger.* der Dornhay. *Fr.* l'Aquillat.—*S.* pinna anali nulla, dorsalibus spinosis, corpore teretiusculo.

(BLOCH. Tab. 85.)

In the European Seas. It has three rows of teeth in each jaw.

2. *Zygæna*. The Balance-fish. *Ger.* der Hammer-fisch. *Fr.* le Marteau.—*S.* capite latissimo transverso malleiformi.

(*Abbild. Nat. Hist. Gegenst.* Tab. 99.)

In most parts of the Ocean.

2. *Carcharias*. The White Shark. *Fr.* le Requin.—*S.* dorso plano, dentibus serratis.

(BLOCH. Tab. 120.)

Particularly numerous in the Atlantic Ocean. It weighs sometimes as much as 10,000lbs. and even whole horses have been found in its stomach. It has six rows of teeth in the jaws, which, as is the case with most Sharks, are not fixed in the bone, but connected with it by a kind of joint. The front row is that which is actually employed in biting. The hinder ones, at least in the young animal, are directed backwards, forming a reserve, from which accidental losses in the front row are supplied as occasion requires.

4. *Pristis*. The Saw-fish. *Ger.* der Säge-fish. *Fr.* la Scie de Mer.—*S.* pinna ani nulla, rostro ensiformi osseo plano utrinque dentato.

(BLOCH. Tab. 120.)

In the North Atlantic Ocean, &c. The broad, sword-like weapon in front of the head, is often several ells long, and has 24 or more strong teeth inserted into its lateral edges.

5. *LOPHIUS*. Sea-devil. *Ger.* Seetufel. *Fr.* Baudroie.—*Pinnæ pectorales branchiis insidentes*. *Spiracula solitaria pone brachia*.

1. *Piscatorius*. (*Rana piscatrix*.) The Frog-fish. *Ger.* der Frosch-fisch. *Fr.* la Grenouille pecheuse.—*L.* depressus capite rotundato.

(*BLOCH.* Tab. 87.)

On the coasts of Europe. Its monstrous head, which forms more than half the bulk of the creature, and the fleshy fibres about its mouth, give this animal a singular appearance.

6. *BALISTES*. Caput compressum. Apertura supra pinnae pectorales. Corpus compressum, squamis corio coadunatis. Abdomen carinatum.

1. *Tomentosus*. The little old Wife.—*B.* pinna capitis biradiata, corpore posterius subvillosa.

(*BLOCH.* Tab. 148. fig. 1.)

In both Indies.

7. *CHIMÆRA*. Spiracula solitaria, quadripartita, sub collo. Oris labium superius quinquepartitum. Dentes primores incisores bini supra infraque.

1. *Monstrosa*. The Sea-ape.—*C.* rostro subtus plicis pertusis.

(*BLOCH.* Tab. 124.)

In the North Atlantic Ocean.

II. BRANCHIOSTEGI.

Cartilaginous fishes with opercula to the gills.

8. *ACCIPENSER*. Spiracula lateralia solitaria, linearia.

Os sub capite, retractile, edentulum. Cirri quatuor sub rostro ante os.

1. *Sturio*. The Sturgeon. *Ger.* der Stör. *Fr.* l'Esturgeon.—*A.* squamis dorsalibus 11.

(*BLOCH.* Tab. 88.)

In all the European and the Caspian Seas ; also in the Wolga, the Nile, &c. This, together with other Species of the Genus, forms an important object of fishery to many nations, as well for its flesh, as for the Caviare prepared from its roe. It sometimes weighs near 1,000lbs. It often happens that many of them follow in a row one after another, a circumstance which has given rise to the fabulous tales of monstrous Sea-Serpents in the North.

2. *Ruthenus*. The Caviar Sturgeon. *Ger.* der Sterlet.—*A.* squamis dorsalibus 15.

(*BLOCH.* Tab. 89.)

This fish, the flesh of which is of a very excellent flavour, is

found in numbers in the Wolga and Caspian Seas. It rarely weighs more than 30lbs.

3. *Huso*. The Beluga. *Ger.* der Hausen.—*A. squamis dorsalibus* 13, *caudalibus* 43.

(BLOCH. Tab. 129.)

In the same places as the former. Is one of the largest fresh water fish. Isinglass is prepared principally from the swim-bladder of this Species, but also from the *A. sturio*—*A. stellatus*, and others. The latter gives the best Caviare. Isinglass is also procured from the *Silurus glanis*.

9. OSTRACION. *Ger.* Panzer-fisch. *Fr.* Poisson coffre.—*Corpus osse integro loricatedum. Pinnæ ventrales nullæ.*

1. *Bicuspis*.—*O. trigonus spinis dorsalibus duabus.*

(*Abbild. Nat. Hist. Gegenst.* Tab. 58.)

On the Coast of China, and also, (unless the *O. stellifer* be a distinct Species) of America.

2. *Triqueter*. The Trunk-fish.—*O. trigonus muticus.*

(BLOCH. Tab. 130.)

In the East Indies.

3. *Cornutus*.—*O. tetragonus, spinis frontalibus subcaudalibus binis.*

(BLOCH. Tab. 133.)

Also in the East Indies. A very elegant little animal, and very regularly marked with hexagons, like a honey-comb.

10. TETRODON. *Corpus subtus muricatum. Pinnæ ventrales nullæ.*

1. *Lagocephalus*. The Globe-fish. *Fr.* le Poisson souffleur.—*T. abdomine aculeato, corpore lævi, humeris prominentibus.*

(BLOCH. Tab. 140.)

Very common in Senegal: those which are taken at some distance up the country are very good eating, whilst those near the sea, at the mouth of the river, are very poisonous.

2. *Electricus*.—*T. corpore maculoso; pinnis viridibus.*

(*Phil. Trans.* Vol. LXXVI. p. 2. Tab. 13.)

One of the five electric fishes at present known. (§ 110.) In the East Indies and Island of St. Johanna.

3. *Hispidus*. The Moon-fish. *Ger.* der Kugelfisch.—*T. totus hispidus, papillis setaceis.*

(BLOCH. Tab. 142.)

In the Red Sea, and also in the fresh waters of the countries in its vicinity.

4. *Mola*. (Luna) The Sun-fish. *Ger.* der Klumpfisch. *Fr.* la Lune de Mer.—*T. lævis compressus, cauda truncata: pinna brevissima dorsali analique annexa.*

(*Hamburg Magazin*. B. 18. Tab. 1.)

Numerous in the Atlantic and Mediterranean. Weighs, occasionally, as much as five hundred weight. It has its German name from its unshapely form, and the English and French from the phosphorescent light of the sides and belly of the living fish.

11. *Diodon*. *Corpus spinis acutis mobilibus undique adspersum. Pinnæ ventrales nullæ.*

1. *Hystrix*. The Porcupine-fish. *Ger.* der Stachelfisch.—*D. oblongus, aculeis teretibus.*

(*Bloch*. Tab. 126.)

Principally in the Atlantic, particularly on the Coasts of North America.

12. *Cyclopterus*.—*Caput obtusum. Pinnæ ventrales in orbiculum connatæ.*

1. *Lumpus*. The Lump-sucker. *Ger.* der See-Hase. *Fr.* le Lievre de Mer.—*C. corpore squamis osseis angulato.*

(*Bloch*. Tab. 90.)

In the Northern Seas of the Old World. Fastens itself to rocks, ships, &c., with great force, by means of the flat grooved plate on the thorax.

13. *Centriscus*. *Caput productum in rostrum angustissimum. Abdomen carinatum. Pinnæ ventrales unitæ.*

1. *Scolopax*. The Snipe-fish. *Ger.* die Meer-Schnepfe.—*C. corpore squamoso scabro, cauda recta extensa.*

(*Bloch*. Tab. 123. fig. 1.)

In the Mediterranean Sea, &c.

14. *Syngnathus*. *Rostrum subcylindricum, ore operculato, maxilla inferiore mobiliore. Corpus cataphractum. Pinnæ ventrales nullæ.*

1. *Acus*. The Pipe-fish. *Ger.* die Meer-nadel.—*S. pinnis caudæ, ani, pectoralibusque radiatis; corpore septemangulato.*

(*Bloch*. Tab. 91. fig. 2.)

In the North Sea, the Baltic, &c.

2. *Hippocampus*. The Sea-horse. *Ger.* das See-Pferdchen.

Fr. le Cheval marin.—*S.* pinna caudæ quadrangulæ nulla, corpore septemangulato tuberculato.

(BLOCH. Tab. 116. fig. 3.)

One of the most generally diffused sea-fish. It has its name from the resemblance of its front part to a horse's head and neck. In dying it bends itself like an S, and then resembles the Knight at Chess.

15. PEGASUS. Os proboscide retractili. Rostrum ensiforme, lineare. Corpus articulatum osseis incisuris, cataphractum. Pinnæ ventrales abdominales.

1. *Draconis*. The Sea-Dragon. *Ger.* der See-drache.—*P.* rostro conico.

(BLOCH. Tab. 109. fig. 1, 2.)

In the East Indies. The large and wide pectoral fins resemble expanded wings, and have probably given origin to its name.

III. APODES.

This and the three following Orders include the osseous fishes, or fishes properly so called.—First those which are without ventral fins.

16. MURÆNA. Caput læve. Nares tubulosæ. Membrana branchiostega radiis 10; corpus teretiusculum lubricum. Pinna caudalis coadunata dorsali anique. Spiracula pone caput vel pinnas pectorales.

1. *Helena*. The Murena.—*M.* pinnis pectoralibus nullis.

(BLOCH. Tab. 153.)

A very voracious fish of prey, found in the seas of both hemispheres.

2. *Anguilla*. The Eel. *Ger.* der Aal. *Fr.* l'Anguille.—*M.* maxilla inferiore longiore, corpore unicolore.

(BLOCH. Tab. 73.)

One of the common fresh water fishes in both hemispheres. It occasionally goes on the land among grass, &c. It is very tenacious of life, its heart when removed from the body retaining its irritability for forty hours. According to the most correct observations it is certainly viviparous*.

17. GYMNOTUS. Caput operculis lateralibus. Tentacula duo ad labium superius. Membrana branchiostega radiis 5. Corpus compressum, subtus pinna carinatum.

* VOIGT's *Neues Magazin*. B. 12. S. 519.

1. *Electricus*. The Electric Eel. *Ger.* der Zitteraal.—*G.* nudus, dorso apterygio, pinna caudali obtussissima anali connexa.

(BLOCH. Tab. 156.)

Particularly in Surinam and Cayenne, where it was first made known by Van Berkel*. About as long as a man †.

18. *TRICHIURUS*. Caput porrectum, operculis lateralibus. Dentes ensiformes, apice semisagittati: primores majores. Membrana branchiostega radiis 7. Corpus compresso-ensiforme. Cauda subulata, aptera.

1. *Lapturus*.—*T.* mandibula inferiore longiore.

(BLOCH. Tab. 158.)

In both Indies.

2. *Indicus*.—*T.* mandibulis æqualibus.

In the East Indies. Also an electrical fish. (§ 110.)

19. *ANARRHICHAS*. Caput obtusiusculum. Dentes primores supra infraque conici, divergentes, sex pluresve, molares inferiores palatique rotundati. Membrana branchiostega radiis 6. Corpus teretiusculum, pinna caudæ distincta.

1. *Lupus*. The Sea-Wolf. *Ger.* der Klippfisch.—*A.* pinnis pectoralibus amplis subrotundis.

(BLOCH. Tab. 74.)

On the Coasts of the North of Europe.

20. *AMMODYTES*. Caput compressum. Labium superius duplicatum, dentes acerosi. Membrana branchiostega radiis 7. Corpus teretiusculum, cauda distincta.

1. *Tobianus*. The Sand-Lance. *Ger.* der Sandfisch.—*A.* maxilla inferiore longiore.

(BLOCH. Tab. 75. fig. 2.)

Also in the North of Europe. It conceals itself in the sand, whence it is taken in numbers on the Coasts of England and Holland.

21. *OPHIDIUM*. Caput nudiusculum. Dentes maxillis palato, faucibus. Membrana branchiostega radiis 7 patula. Corpus ensiforme.

* See *Sammlung seltener und merkwürdiger Reisegeschichten*. 1 Th. Memmingen, 1789. S. 220.

† For an admirable description of the manner in which the Indians exhaust the electric power of these animals, and then take them without danger, by driving horses and mules into the ponds in which they abound, see ALEX. v. HUMBOLDT'S *Ansichten der Natur*. 1 B. S. 37, &c.

1. *Imberbe*.—*O. maxillis imberbibus, cauda obtusiuscula.*
(*British Zoology. Appen. Tab. 93.*)

On oyster banks, in great numbers. It is the most destructive enemy of oysters, and is often found held between their shells.

22. *STROMATEUS*. Caput compressum. Dentes in maxillis, palato. Corpus ovatum, latum, lubricum. Cauda bifida.

1. *Paru*.—*S. unicolor.*

(*BLOCH. Tab. 160.*)

In America.

23. *XIPHIAS*. Caput maxilla superiore terminatum rostro ensiformi. Os edentulum. Membrana branchiostega radiis 8. Corpus teretiusculum.

1. *Gladius*. The Sword-fish. *Ger. der Schwertfisch.*—*X. mandibula inferiore acuta, triangulari.*

(*BLOCH. TAB. 76.*)

In the Northern and Southern Ocean: with its sword is about eighteen feet long, and weighs about 500lbs. Its flesh is well tasted, and it forms an important object of fishery to the Calabrians and Sicilians*.

24. *LEPTOCEPHALUS*. Caput exile. Corpus elongatum, tenuissime compressum. Pinnæ pectorales minutæ.

1. *Morrisii*. (*LEACH'S Zoolog. Miscell. Vol. III. Tab. 126.*)

On the English Coasts.—Like a small transparent band. A very similar Species of this remarkable Genus has been sent to me from the Coast of South Africa, by the Reverend M. HESSE.

IV. JUGULARES.

Fishes having the ventral in front of the pectoral fins.

25. *CALLIONYMUS*. Caput labio superiore duplicato: oculi approximati. Membrana branchiostega radiis 6: apertura nuchæ foraminibus respirante. Opercula clausa. Corpus nudum. Pinnæ ventrales remotissimæ.

1. *Lyra*. The Piper.—*C. dorsalis prioris radiis longitudine corporis.*

(*BLOCH. Tab. 161.*)

In the Atlantic.

26. *URANOSCOPIUS*. Caput depressum, scabrum, majus. Os simum, maxilla superior brevior. Membr. branch. radiis 5; anus in medio.

* JAC. PH. D'ORVILLE. *Sicula. T. 1. p. 272, &c.*

1. *Scaber*. The Stargazer. *Ger.* der Sternseher. *Fr.* le Bœuf.
—*U. cirris multis in maxilla inferiore.*

(BLOCH. Tab. 163.)

Very numerous in the Mediterranean.

27. *TRACHINUS*. Caput scabriusculum, compressum.
Membr. branch. radiis 6 ; anus prope pectus.

1. *Draco*. The Sting-fish. *Ger.* das Petermännchen. *Fr.* la Vive. (*TRACHINUS*.)

(BLOCH. Tab. 61.)

In the Mediterranean, the North Sea, &c.

28. *GADUS*. Corpus læve. Membr. branch. radiis 7 tere-
tibus ; pinnæ cute communi vestitæ, pectorales acu-
minatæ.

1. *Æglefinus*. The Haddock. *Ger.* der Schellfisch. *Fr.* l'Anon.
—*G. Tripterygius cirratus albicans, cauda biloba, maxilla
superiore longiore.*

(BLOCH. Tab. 62.)

In all the Northern European Seas, but particularly on the
coasts of England and Scotland.—Many fishes are phosphores-
cent after death, in certain circumstances ; in this, however,
the phenomenon in question is occasionally of unusual extent
and duration*.

2. *Callarias*.—*G. tripterygius cirratus varius, cauda integra,
maxilla superiore longiore.*

BLOCH. Tab. 63.)

In nearly the same situations as the first Species.

3. *Morrhua*. The Cod. *Ger.* der Kabeljau. *Fr.* la Morue
(Asellus).—*G. tripterygius cirratus, cauda subæquali, ra-
dio primo anali spinoso.*

(BLOCH. Tab. 64.)

Under this general name are included many closely connected
Species of this Genus, which are of extreme value, on account
of their immense numbers, the variety of methods of preserv-
ing them, and the length of time they may be kept. They are
found in the Northern parts of both the Atlantic and Pacific
Oceans, and form a most important fishery on the Coasts of
Labrador, Newfoundland, Iceland, and the North of Great Bri-
tain†.

4. *Merlangus*. The Whiting. *Ger.* der Witling. *Fr.* le Mer-

* OSIANDER'S *Denkwürdigkeiten für die Heilkunde*, &c. B. 1. S. 417, &c.

† Du HAMEL *Traité général des Pêches*. P. 2. Sect. p. 56, &c.

lan.—*G. tripterygius imberbis albus*, maxilla superiore longiore.

(BLOCH. Tab. 65.)

In the European Seas.

5. *Lota*. The Burbot. *Ger.* die Quappe. *Fr.* la Lote.—*G. dipterygius cirratus*, maxillis æqualibus.

(BLOCH. Tab. 70.)

Principally in the Lakes of Switzerland. The most delicate German fish.

29. *BLENNIUS*. Caput declive, tectum. Membr. branch. radiis 6 ; corpus lanceolatum, pinna ani distincta.

1. *Viviparus*. The Eel-pout. *Ger.* der Aalmutter.—*B. ore tentaculis duobus*.

(BLOCH. Tab. 72.)

In the Mediterranean, the North Sea, &c. It is viviparous.

V. THORACICI.

Fishes with the ventral immediately below the pectoral fins.

30. *CEPOLA*. Caput subrotundum compressum. Os simum, dentes curvati, simplici ordine. Membr. branch. radiis 6 ; corpus ensiforme, nudum, abdomine vix capitis longitudine.

1. *Tænia*. The Ribbon-fish. *Ger.* der Bandfisch. *Fr.* le Ruban.—*C. pinna caudæ attenuata*, capite obtusissimo.

(BLOCH. Tab. 170.)

In the Mediterranean.

31. *ECHENEIS*. Caput depressum, supra planum marginatum, transverse sulcatum. Membr. branch. radiis 10.

1. *Remora*. The Sucking-Fish. *Ger.* der Saugefisch. *Fr.* le Sucet.—*E. cauda bifurca*, striis capitis 18.

(*Abbild. Nat. Hist. Gegenst.* Tab. 78.)

In the temperate parts of the Ocean. This singular animal can attach itself most firmly, by means of the grooves on the back part of its head, to ships, sharks, &c. Hence, the fable, that it was able to stop a ship in full sail.

32. *CORYPHÆNA*. Caput truncato-declive. Membr. branch. radiis 5 ; pinna dorsalis longitudine dorsi.

1. *Hippurus*. The Dolphin. *Ger.* der Goldkarpfe. *Fr.* la Dorade.—*C. cauda bifida*, radiis dorsalibus 60.

(BLOCH. Tab. 174.)

In the Atlantic. A splendid animal, which displays a variety of colours in dying, as yellow, blue, purple, red, &c.

33. *Gobius*. Caput poris 2 inter oculos approximatos, altero anteriore. Membr. branch. radiis 4; pinnae ventrales unitae in ovatum.

1. *Niger*. The Sea Gudgeon. *Ger.* die Meergrundel.—*G.* pinna dorsali secunda radiis 14.

(BLOCH. Tab. 38. fig. 1, 2, 5.)

In the Atlantic and Indian Oceans.

34. *Cottus*. Caput corpore latius, spinosum. Membrana branchiostega radiis 6.

1. *Cataphractus*. The Pogge. *Ger.* der Knurrhahn.—*C.* loricatus rostro verrucis bifidis, capite subtus cirroso.

(BLOCH. Tab. 38. fig. 3, 4.)

On the Northern Coasts of Europe and America.

2. *Gobio*. The Miller's Thumb. *Ger.* der Kaulkopf. *Fr.* le Chabot.—*C.* laevis, capite spinis duabus.

(BLOCH. Tab. 38.)

Very common in the rivers of Europe. The female deposits her spawn in a hole, and watches it until the young ones are hatched.

35. *SCORPÆNA*. Caput magnum, aculeatum. Oculi vicini. Dentes maxillis, palato, faucibusque. Membrana branchiostega radiis 7.

1. *Horrida*.—*S.* tuberculis callosis adpersa.

In the East Indies.

(BLOCH. Tab. 183.)

36. *ZEUS*. Caput compressum, declive. Labium superius membrana transversa fornicatum. Lingua subulata. Membr. branch. radiis 7 perpendicularibus: infimo transverso. Corpus compressum.

1. *Vomer*. The Silver-Fish.—*Z.* cauda bifurca, spina ante pinnam analem dorsalemque recumbente.

(BLOCH. Tab. 139.)

2. *Faber*. The Dory.—*Z.* cauda rotundata; lateribus mediis oculo fusco: pinnis analibus duabus.

(BLOCH. Tab. 41.)

Both in the Atlantic.

37. *PLEURONECTES*. (Flounder. *Ger.* Butte. Scholle. *Fr.* Sole.) Oculis utrisque in eodem latere frontis. Membr. branch. radiis 4-7; corpus compressum, latere altero dorsum, altero abdomen referente.

These are the only animals in which both eyes are on one side of the head ; in some Species on the right, in others on the left. It is uncommon to find monsters among them, in which the eyes are on the wrong side of the head. Both the nostrils, also, open obliquely to one side. They swim in an inclined position, the eyes being turned uppermost.

1. *Platessa*. The Plaice. *Ger.* die Scholle. *Fr.* la Plie.—P. oculis dextris, corpore glabro, tubercul 6 capitis.

(BLOCH. Tab. 42.)

With the following, principally in the Northern Seas.

2. *Flesus*. The Flounder. *Ger.* der Flünder. *Fr.* le Flet.—P. oculis dextris, linea laterali aspera, spinulis ad pinnas.

(BLOCH. Tab. 44.)

3. *Limanda*. The Dab. *Ger.* die Glahrke.—P. oculis dextris, squamis ciliatis, spinulis ad radicem pinnarum dorsi anique, dentibus obtusis.

(BLOCH. Tab. 46.)

4. *Hippoglossus*. The Halibut. *Ger.* die Heiligbutte. *Fr.* le Fletang.—P. oculis dextris, corpore toto glabro.

(BLOCH. Tab. 47.)

It often weighs as much as four hundred weight. Among other places, in great numbers in the North of the Pacific Ocean.

5. *Maximus*. The Turbot. *Ger.* die Steinbutte.—P. oculis sinistris, corpore aspero.

(BLOCH. Tab. 49.)

Much smaller. One of the best tasted fishes.

38. *CHÆTODON*. Dentes (*plurimis*) setacei, flexiles confertissimi, numerosissimi. Membr. branch. radiis 6 ; corpus pictum ; pinna dorsi anique carnosissima.

1. *Rostratus*.—C. cauda integra, spinis pinnæ dorsalis 9 ; maculaque ocellari ; rostro cylindrico.

(BLOCH. Tab. 202.)

In the East Indies. The upper-jaw ends in a tube, through which the fish throws water on the insects upon aquatic plants, so that they may fall and become its prey.

2. *Macrolepidotus*.—C. cauda integra, spinis dorsalibus 11, radio dorsali quarto filiformi longissimo.

(BLOCH. Tab. 200.)

In the East Indies.

39. *SPARUS*. Dentes primores robusti, molares obtusi, conferti. Labia simplicia. Membr. branch. radiis

5 ; corpus compressum. Pinnæ pectorales acuminatæ.

1. *Aurata*. The Gilthead. *Ger.* der Goldbrachsen.—*S. lunula aurea* inter oculos.

(BLOCH. Tab. 266.)

In the Mediterranean and Atlantic. It has its name in almost every language, from the golden crescent before its eyes.

2. *Sargus*. The Sea Bream. *Ger.* der Greissbrachsen.—*S. ocello subcaudali, corpore fasciis nigris.*

(BLOCH. Tab. 264.)

In the Mediterranean. At the season of copulation, the males dispute the possession of the females, like birds, &c.

3. *Pagrus*.—*S. rubescens*, cute ad radicem pinnarum dorsi et ani in sinum producta.

(BLOCH. Tab. 267.)

One of the most common Sea-fish : occasionally poisonous.

40. LABRUS. Dentes acuti, labia duplicata magna. Membr. branch. radiis 6 ; pinnæ dorsalis radii postice ramento filiformi aucti. Pectorales rotundatæ.

1. *Julis*. The Rainbow-fish. *Ger.* der Meerjunker. *Fr.* la Girelle.—*L. lateribus cærulescentibus, vitta longitudinali fulva utrimque dentata.*

(BLOCH. Tab. 287.)

In the Mediterranean. As long as a finger, and with very beautiful colours. Its bite makes it very troublesome to bathers.

41. SCIENÆ. Caput totum squamis obtectum. Membr. branch. radiis 6 ; opercula squamosa. Corpus fossula dorsi pro pinna dorsali recondenda.

1. *Nigra*.—*S. tota nigra, ventre fusco-albescente.*

(BLOCH. Tab. 297.)

Together with many other Species of this Genus, in the Red Sea.

42. PERCA. Opercula spinosa antrorsum serrata. Membr. branch. radiis 7 ; corpus pinnis spinosis. Linea lateralis cum dorso arcuata.

1. *Fluviatilis*. The Perch. *Ger.* der Barsch. *Fr.* la Perche.—*P. pinnis dorsalibus distinctis, secunda radiis 16.*

(BLOCH. Tab. 52.)

In Europe and the North of Asia.

2. *Lucioperca*. *Ger.* der Zander.—*P. pinnis dorsalibus distinctis, secunda radiis 23.*

(BLOCH. Tab. 51.)

Together with the following Species in the North of Europe. It is of excellent flavour in the Lakes of Hungary, and of great size in the Danube.

3. *Cernua*. The Ruff. *Ger.* der Kaulbarsch. *Fr.* le Post.—
P. pinnis dorsalibus unitis radiis 27; spinis 15; cauda bifida.

(BLOCH. Tab. 53. fig. 2.)

43. *GASTEROSTEUS*. Membr. branch. radiis 3; corpus ad caudam utrinque carinatum. Pinnæ ventrales pone pectorales, sed supra sternum.
1. *Aculeatus*. The Stickleback, *Ger.* der Stichling.—G. spinis dorsalibus tribus.

(BLOCH. Tab. 53. fig. 3.)

In Europe. Only used as food for swine, and as manure.

2. *Ductor*. The Pilot-fish. *Ger.* der Lootsmann. *Fr.* le Pilote.—G. spinis dorsalibus 4; membrana branchiostega 7 radiata.

This celebrated little fish is always found accompanying, or preceding, the formidable Shark, *Squalus carcharias*. Some exaggeration excepted, the fact has recently been confirmed by authentic observation*.

44. *SCOMBER*. Caput compressum, læve. Membr. branch. radiis 7; corpus læve, linea laterali postice carinatum. Pinnæ spuriae sæpe versus caudam.
1. *Scomber*. The Mackerel. *Ger.* die Makrele. *Fr.* le Maquereau.—S. pinnulis 5.

(BLOCH. Tab. 54.)

In the Northern and Atlantic Ocean, &c. With the following Species very voracious, but very well tasted. The ancients made the dish called "garum," from both.

2. *Pelamys*. The Boneto. *Ger.* die Bonite.—S. pinnulis inferioribus 7; abdomine lineis utrinque 4 nigris.

In the Seas of the warmer parts of the World. It is sometimes very phosphorescent after death, and may, probably, with other fish and their oil, contribute to the shining of seawater.

3. *Thynnus*. The Tunny. *Ger.* der Thunnfisch. *Fr.* le Thon.—S. pinnulis utrinque 8.

(BLOCH. Tab. 55.)

* G. ST. HILAIRE in his *Memoires d'Histoire Naturelle*, p. 5, &c.

In the North Sea, the Mediterranean, East and West Indies, &c. It is longer than a man, and may weigh more than five hundred weight. It is sometimes poisonous*. The Albicore, made known by the South Sea voyages, resembles it.

45. *MULLUS*. Caput compressum, declive, squamis tectum. Membr. branch. radiis 3; corpus squamis magnis facile deciduis.

1. *Barbatus*. The Red Mullet. *Ger.* die Rothbarbe. *Fr.* le Rouget.—*M. cirris geminis, corpore rubro.*

(*BLOCH*. Tab. 348. fig. 2.)

Principally in the Mediterranean. About a foot long. Famous as an article of luxury among the ancient Roman Epicures, and also for the splendid colours which it, together with the true Dolphin (p. 160.) and other fishes display in dying †.

The *M. surmuletus* (*BLOCH*. Tab. 47.) appears to me, after a strict comparison, not to be specifically distinct.

46. *TRIGLA*. Caput loricatum lineis scabris. Membr. branch. radiis 7; digiti liberi ad pinnas pectorales.

1. *Volitans*. The Flying-fish.—*T. digitis vicenis membrana palmatis.*

(*BLOCH*. Tab. 351.)

One of the Flying-fish of the Seas of temperate climates.

VI. ABDOMINALES.

Fishes in which the abdominal are placed behind the pectoral fins. Most fresh-water fish belong to this order.

47. *COBITIS*. Oculi in suprema capitis parte. Membr. branch. radiis 4-6: cauda versus pinnam minus angustata.

1. *Anableps*.—*C. cirris 2; capite depresso, oculis prominulis.*

(*BLOCH*. Tab. 361.)

In Surinam. Is viviparous, and is remarkable for the form of the cornea, which appears as though divided into two sections, together with the peculiar direction of the pupil ‡.

2. *Barbatula*. The Loach. *Ger.* der Schmerling. *Fr.* la Loche.
—*C. cirris 6, capite inermi compresso.*

* For an account of its fishery, see *HOUEL, Voyage pittoresque de Sicile, &c.* Paris, 1782. fol. Vol. I. Tab. 28-30.

† *SENECA. Quæstion. Natural.* l. 3. c. 17, &c.

‡ *D. W. SÖMMERING de oculor. hominis et animal. sect. horizont.* Götting. 1818. fol. p. 68. seq. Tab. 3.

(BLOCH. Tab. 31. fig. 3.)

In many varieties, with and without cirri, &c. The largest are found in the Aar, in Switzerland.

3. *Fossilis*. The Mud-fish. *Ger.* der Wetterfisch.—*C. cirris* 6, spina supra oculos.

(BLOCH. Tab. 31. fig. 1.)

In Europe. Like the *Cottus cataphractus*, it can make a noise. When kept in a glass with sand at the bottom, it becomes uneasy on a coming change of weather*.

48. *SILURUS*. Caput nudum. Os cirris filiformibus tentaculatum. Membr. branch. radiis 4-14; radius pinnae pectoralis aut dorsalis primus spinosus, retrodentatus.

1. *Glanis*. *Ger.* der Wels.—*S. pinna dorsali unica mutica*, cirris 6.

(BLOCH. Tab. 34.)

In the temperate regions of the Old World. With the Beluga, one of the largest fresh-water fishes, weighing as much as three hundred weight. It has a remarkable appearance from its large unshapely head, and its long cirri.

2. *Cataphractus*.—*S. pinna dorsali posticae* nudiata, squamis ordine simplicibus; cirris 6; cauda integra.

(CATESBY. Vol. III. Tab. 19.)

In North America.

3. *Electricus*. *Ger.* der Zitter-Wels. *Fr.* Trembleur.—*S. pinna dorsali unica lumbari*, remota absque radiis, cirris 6.

(BROUSSONET, in *Mem. de l'Acad. des Sc. de Paris*. 1792. Tab. 20.) An Electric fish. (§ 110.) Found in the Nile and other African rivers. It is twenty inches long, and may be eaten.

49. *LORICARIA*. Caput læve depressum. Os edentulum retractile. Membr. branch. radiis 6; corpus cataphractum.

1. *Plecostomus*. The Harness-fish.—*L. pinnis dorsis duabus*.

In South America.

(BLOCH. Tab. 374.)

50. *SALMO*. Caput læve. Dentes in maxillis, lingua. Membr. branch. radiis 4-10; pinna dorsalis postica adiposa: pinnae ventrales multiradiatae.

1. *Salar*. The Salmon. *Ger.* der Lachs. *Fr.* le Saumon.—*S. rostro ultra inferiorem maxillam prominente*.

* LEISLER, in *Sylvan, von LAUROPS* u. FISCHER. f. d. j. 1814.

(BLOCH. Tab. 20-98.)

In the Northern seas and rivers, and occasionally, as in Labrador and the country of Amur, in vast numbers. In Summer it inhabits rivers, and in Winter the sea. It is one of the fishes which increases most rapidly. The males only have the lower jaw bent. The women of the Orotchys-Tungooses have the art of tanning its skin so as to be flexible, for the purposes of clothing.

2. *Trutta*. The Salmon Trout. *Ger.* die Lachs-Forelle. *Fr.* la Truite saumonée.—*S. ocellis nigris iridibus brunneis, pinna pectorali punctis 6.*

(BLOCH. Tab. 21.)

On the coasts, and in the rivers of Europe. Weighs eight or ten pounds.

3. *Fario*. The Trout. *Ger.* die Forelle. *Fr.* la Truite.—*S. maculis rubris, maxilla inferiore sublongiore.*

(BLOCH. Tab. 22-23.)

In shaded brooks of the mountains of the temperate regions of Europe and Asia. Seldom weighs more than two pounds. Varies much in colour and taste.

4. *Alpinus*. The Char. *Ger.* die Bergforelle.—*S. dorso nigro lateribus cæruleis, ventre fulvo.*

(BLOCH. Tab. 104.)

In the Alpine and Northern parts of Europe. Of great value to the Swedish Laplanders, who occasionally subsist almost entirely upon it. Lives principally on Gnats (*culex pipiens*.)

5. *Eperlanus*. The Smelt. *Ger.* der Grosse Stint.—*S. capite diaphano, radiis pinnæ ani 17.*

(BLOCH. Tab. 28. fig. 2.)

In the North of Europe. Is almost transparent. The Greenland Herring (*Salmo arcticus*), of which the Greenlanders make their principal nourishment next to the Seal, resembles it.

6. *Lavareus*. *Ger.* der Gang-fisch.—*S. maxilla superiore longiore, radiis pinnæ dorsi 14.*

(BLOCH. Tab. 25.)

In the North Sea, Baltic, Hudson's Bay, &c. To this also probably belong the *Felchen* and *Aalbock* of the Lake of Thun, which appear to be the same with the *Ferra* of the Lake of Geneva.

7. *Thymallus*. The Grayling. *Ger.* die Aesche. *Fr.* l'Ombre.—*S. maxilla superiore longiore, pinna dorsi radiis 23.*

(BLOCH. Tab. 24.)

In temperate Europe and Siberia.

51. *FISTULARIA*. Caput: rostrum cylindricum, apice maxillosum. Membr. branch. radiis 7: corpus.

1. *Tabacaria*. The Tobacco-pipe.—F. cauda bifida setifera.

(BLOCH. Tab. 387.)

Found on the Eastern Coasts of tropical America, and in New Holland. A singularly formed animal, with a very small mouth on an immensely long snout.

52. *Esox*. Caput supra planius culum; mandibula superiore plana brevior, inferiore punctata: dentes in maxillis, lingua. Membr. branch. radiis 7-12.

1. *Lucius*. The Pike. Ger. der Hecht. Fr. le Brochet.—E. rostro depresso subæquali.

(BLOCH. Tab. 32.)

In many rivers and lakes of Europe, Asia and North America. A most voracious animal, which devours not only fish, but also Amphibia of all kinds, Toads, &c., many aquatic birds, small quadrupeds, and even crabs.

2. *Belone*. The Garpike. Ger. der Kornfisch. Fr. l'Orphie.—A. rostro utraque maxilla subulato.

(BLOCH. Tab. 33.)

In the European Seas, and often in vast numbers.

53. *POLYPTERUS*. Membr. branch. radio unico. Spiracula utrinque bina in vertice. Pinnæ dorsales numerosæ.

1. *Bichir*. (GEOFFRY ST. HILAIRE *Mémoires d'Histoire Naturelle*. Tab. 5.)

In the Nile. About nine inches long, of a sea-green colour, and covered with long scales. Its numerous dorsal fins (16, and upwards,) its pectoral and abdominal fins placed like legs, together with many other remarkable peculiarities, designate this animal as a distinct Genus.

54. *ELOPS*. Caput læve. Dentium scabrities in maxillarum margine, palato. Membr. branch. radiis 30; preterea exterius in medio armata dentibus 5.

1. *Saurus*. E. cauda supra infraque armata.

(BLOCH. Tab. 393.)

In Jamaica.

55. *ARGENTINA*. Dentes in maxillis, lingua. Membr. branch. radiis 8. Corpus ano caudæ vicino. Pinnæ ventrales multiradiatæ.

1. *Carolina*.—A. pinna anali radiis 15.

(CATESBY. Vol. II. Tab. 24.)

It has its name from its native country.

56. *ATHERINA*. Caput maxilla superiore planiuscula. Membr. branch. radiis 6. Corpus fascia laterali argentea.

1. *Hepsetus*. A. pinna ani radiis fere 12.

(BLOCH. Tab. 393. fig. 3.)

In the Mediterranean.

57. *MUGIL*. Caput: labia membranacea: inferius introrsum carinatum. Dentes nulli. Denticulus inflexus supra sinus oris. Membr. branch. radiis 7, curvis. Opercula lævia rotundata. Corpus albicans:

1. *Cephalus*. The Common Mullet.—M. pinna dorsali anteriore quinquerradiata.

(BLOCH. Tab. 394.)

In the Mediterranean and other Seas.

58. *EXOCOETUS*. Caput squamosum. Os edentulum, maxillis utroque latere connexis. Membr. branch. radiis 10. Corpus albicans, abdomen angulatum, pinnæ pectorales maxime volatiles, radiis antice carinatis.

1. *Volitans*.—E. abdomine utrinque carinato.

The most common of all flying-fishes. Found in almost all the Seas of the warmer parts of the World, and often in great numbers.

The *Exocoetus mesogaster*. (*Abbild. Nat. Hist. Gegenst.* Tab. 100.) The rarest Species of this Genus is found principally in the West of the Atlantic Ocean, and is distinguished by the position of the abdominal fins in the middle of the belly, and by the middle rays in them being the longest.

59. *POLYNEMUS*. Caput compressum, undique squamosum: rostro obtusissimo prominente. Membr. branch. radiis 5-7. Corpus digitis liberis ad pinnas pectorales.

1. *Quinquarius*. P. digitis quinque corpore longioribus.

(SEBA. Vol. III. Tab. 27. fig. 2.)

In the West Indies.

60. *CLUPEA*. Caput maxillarum superiorum mystacibus serratis. Membr. branch. radiis 8. Branchiæ interne setaceæ. Abdominis carina serrata. Pinnæ ventrales sæpe novemradiatæ.

1. *Harengus*. (Membras?) The Herring. *Ger.* der Häring. *Fr.* l'Hareng.—C. immaculata, maxilla inferiore longiore.

(BLOCH. Tab. 29.)

A most important animal in the Northern World. Though attacked by man and many animals, as the Grampus, Gulls, &c., it multiplies with astonishing rapidity. Its great and regular migrations during Summer along the Coasts of Europe, particularly the Orcades, Norway, &c. have given employment to many thousand people from the 12th Century.

2. *Sprattus*. The Sprat. Ger. die Sprotte. Fr. la Sardine.
—C. pinna dorsali radiis 13.

(BLOCH. Tab. 29. fig. 2.)

Also in the Northern and Mediterranean Seas. Has been incorrectly supposed by many naturalists to be the young Herring.

3. *Alosa*. The Shad. Ger. die Alose. Fr. l'Alose.—C. lateribus nigro maculatis, rostro nigro.

(BLOCH. Tab. 30. fig. 1.)

Very abundant in the Mediterranean, but also in the North and Baltic Seas.

4. *Engrasicolus*. The Anchovy. Ger. die Sardelle. Fr. l'Anchois.—C. maxilla superiore longiore.

(BLOCH. Tab. 30. fig. 2.)

Found in the same places with the last. Is taken in great numbers at Gorgona, in the Gulf of Leghorn.

61. *CYPRINUS*. Caput ore edentulo. Os nasale bisulcum.
Membr. branch. radiis 3. Corpus læve albens. Pinnæ ventrales saepe novemradiatæ.

1. *Barbus*. The Barbel. Ger. die Flussbarbe. Fr. le Barbeau.
—C. pinna ani radiis 7, cirris 7, pinnæ dorsalis radio secundo utrinque serrato.

(BLOCH. Tab. 18.)

In temperate Europe and the West of Asia. Its roe is poisonous, and has often given rise to dangerous symptoms when eaten.

2. *Carpio*. The Carp. Ger. der Karpfe. Fr. la Carpe.—C. pinna ani radiis 9, cirris 4, pinnæ dorsalis radio secundo postice serrato.

(BLOCH. Tab. 16.)

At the present time, in almost the whole of Europe. It has been gradually introduced into the Northern parts, within the last 300 years. It produces Bastards with the Crucian and other connected Species.—Monsters are more numerous in this than any other Species of fish. The Mirror Carp, (BLOCH.

Tab. 17.) remarkable for having parts of the body bare of scales, appears to be a distinct Species, and not a Variety of this one.

3. *Tinca*. The Tench. *Ger.* die Schleihe. *Fr.* la Tanche.—
C. pinna ani radiis 25, cauda integra, corpore mucoso, cirris 2.

(BLOCH. Tab. 19.)

One of the most generally diffused river fish. It can produce a sound through its branchial opercula. The Gold Tench (BLOCH. Tab. 15.) is one of the most beautiful German fishes.

4. *Carassus*. The Crucian. *Ger.* die Karausche. *Fr.* le Carassin.—C. pinna ani radiis 10, cauda integra linea laterali recta.

(BLOCH. Tab. 11.)

In Europe and central Asia.

5. *Auratus*. The Gold-fish. *Ger.* der Goldkarpfe. *Fr.* la Dorée.—C. Pinna ani gemina, caudæ bifida transversa bifurca.

(BASTER in *Haarlem Verhandel.* 7. D. 1 st. with col. pl.)

In Japan and China, where it is kept as a domestic animal, and has deviated into many surprising, almost monstrous varieties, as regards its colour, the number and form of fins, the size of the eyes, &c. It also thrives well in temperate Europe. It may be kept in water for any length of time without food, and yet discharges excrement from time to time.

6. *Phoxinus*. The Minnow. *Ger.* die Elritze. *Fr.* le Vairon.—
C pinna ani radiis 8, macula fusca ad caudam, corpore pellucido.

(BLOCH. Tab. 8. fig. 5.)

Very abundant in the Weser.

7. *Orfus*. *Ger.* der Orf.—C. pinna ani radiis 13.

(BLOCH. Tab. 96.)

Principally in the South of Germany. Of a beautiful orange colour.

8. *Alburnus*. The Bleak. *Ger.* der Ukley. *Fr.* l'Ablette.—C. pinna ani radiis 20.

(BLOCH. Tab. 8. fig. 4.)

Together with the following Species, in the middle of Europe, and West of Asia. About as long as a finger. Its scales are used in the manufacture of artificial pearls*.

* BECKMANN'S *Beyträge zur Geschichte der Erfindungen.* 2 B. S. 35 u. f.

9. *Brama*, The Bream, *Ger.* der Brachsen. *Fr.* la Brème.—
C. pinna ani radiis 27; pinnis fuscis.

(BLOCH. Tab. 13.)

SECT. VIII.

OF INSECTS.

§ 121. The animals of the two last classes (§ 40.), Insects and Vermes, are distinguished from the preceding by the absence of red blood, in place of which they have a white fluid. Hence, they were formerly called bloodless animals, (*animalia exsanguia*,) whilst in recent times, on account of the absence of vertebræ and ribs, they have received the name of Invertebral Animals.

§ 122. Insects derive their name from the circumstance, that, at least in the perfect state, the head, thorax, and abdomen are separated from one another, as though by incisions, nay, in many cases, seem as though connected only by a thread. Besides this, however, they are distinguished, with a few exceptions among the Genera of the Apterous Order, by peculiar and often very sensible organs, which, in the perfect state, are affixed to the head, (*Antennæ*, *feelers*,) which are always articulated at the root, and in addition, often formed into several joints; and lastly, by their horny, jointed legs, the number being always greater than in other animals; in perfect insects at least six, and in many instances, as many as one hundred and fifty, &c.

§ 123. These characters excepted, insects, in general, have but little in their external appearance that is common to all. The almost incalculable number of Species, the endless variety of offices they are destined to perform, and the consequent difference of their modes of life, wants, &c. require an extreme diversity in their forms, in which respect, as well as in the inequality of their sizes, we find remarkable contrasts.

§ 124. Even their external coverings are much more diversified than is the case among other animals. Many are pro-

ted by a horny coat, composed of several portions, moving on one another like the pieces of a gauntlet, which serve to secure them from the effects of various accidents, and to compensate the deficiency of bones, which in other animals afford attachment to muscles, &c. Many are covered with fine hairs, and in Butterflies, &c. the wings with little feathers or rather scales, which are occasionally of most beautiful colours: indeed, I may remark, that many animals of undescribable beauty are included in this class.

§ 125. Insects also differ materially from other animals, with regard to the disposition of their organs of sense*, and, probably, their mode of sensation, insomuch that, many naturalists have refused them certain of our external senses, as hearing and smell; but without justice, as the former clearly exists in many which emit certain sounds, as an enticement at the time of breeding, and the latter in a still greater number, which are capable of smelling out their food, though hidden.

§ 126. The eyes of Insects are particularly remarkable, and with respect to their structure, are of two kinds. The first are large hemispheres, mostly composed of thousands of facets, but in some instances, of numerous conical points, and covered on the inner surface with a layer sometimes glittering, sometimes variegated. Such are found in most winged Insects, but also in many Aptera, as the lobster, &c. Those of the second kind (stemmata, ocelli,) are simple, small; and vary as well in number as position. Eyes of the first kind seem calculated for seeing at a distance; of the second, for looking at near objects; at least it may be supposed so, as we find that Butterflies, in their winged perfect state, have such large, compound, telescopic eyes, whilst as Caterpillars, they have small myopic ones. Only a few Insects, crabs, for instance, can move their eyes †.

§ 127. The Antennæ ‡ (feelers) which vary much in diffe-

* M. CH. GOTT. LEHMANN *de sensibus externis animalium exsanguium; Commentatio præmio regio ornata.* Götting. 1798. 4to. And Jos. SCHELVER's *Versuch einer Natur-Geschichte der Sinneswerkzeuge bey den Insecten und Würmern.* Götting. 1798. 8vo.

† From this fact may be deduced a probable explanation of at least one object of the numerous *Facets* of which the compound eyes of Insects are composed. (Translator.)

‡ M. CH. GOTT. LEHMANN *de Antennis Insectorum.* Diss. 1, 2. Lond. 1800. 8vo.

rent Species, in many instances even according to the sex, and which many naturalists have supposed to be organs of smell, taste, &c., seem to be nothing more than their name implies—organs of feeling, probes, which are of great importance to Insects on account of their hard, insensible covering, and the immobility of their eyes in most instances. They appear to possess their most acute feeling in the Antennæ, as man has in the tips of the fingers; and as for the most part they live in darkness, supply the want of light by this contrivance. On the other hand, the purposes of the *Palpi*, placed near the organs of mastication, found in almost all Insects, and considered by some naturalists to be organs of sense, are as yet undetermined.

§ 128. In their internal structure* also, Insects differ materially from red-blooded animals.—For instance, what has been considered as a heart in Caterpillars, is a long canal of unequal width, placed along the back, but without any vessel arising from it; consequently, the nutrition of these Insects must be effected in a peculiar manner, totally different from that of red-blooded animals. On the other hand, they are provided with an incalculable number of air-vessels of an astonishingly delicate structure, and with numerous muscles, differing, however, as well in form as in colour, from those of red-blooded animals.

§ 129. Although Insects stand in need of the exchange of carbon of oxygen to effect the continuance for life, (§ 24), there are but few, as Crabs, Grass-hoppers, many Cicadæ and Chafers, in which a motion resembling respiration can be observed. Insects in general breathe, not by the mouth, but by many *spiracula*†. The greater number of them can live in a vacuum much longer than red-blooded animals, and many in mephitic atmospheres so fatal to others, and in which animal and vegetable substances become putrid, as carburetted hydrogen gas, &c.

§ 130. The abode of Insects on and under the surface of the earth, is much less limited than that of the other Classes of animals. They are found on almost all warm-blooded ani-

* See my *Manual of Comparative Anatomy*, p. 272, &c.

† On the other hand, this Class, in proportion to its vast number of Species, contains but few aquatic animals: and of these, but very few exist in the Ocean, which forms the abode of by far the greater number of Species in the preceding and succeeding Classes.

mals, and even the larger Insects, as Bees, Chafers, &c., are infested by peculiar kinds of lice. There are but few plants, also, (such as perhaps, the Yew, Savine, and most tree-mosses,) which do not serve for the abode and support of known Insects. Many again, as the Oak, are frequented and inhabited by more than a hundred distinct Species. Generally, however, as Insects are diffused over the earth, the residence of individual Species is not less frequently limited to a very small number of animals and plants, or even particular parts of them.

§ 131. Only a few Insects live in a social state, affording mutual assistance in their labours. The greater number follow their pursuits singly; many, as Spiders, live in society when young, but afterwards separate and live in a state of solitude, seeing creatures of the same Species only at the time of pairing.

§ 132. The remarkable edifices and habitations, which so many Insects are capable of executing, have been already mentioned in speaking of Instinct. (§ 36.) There are but few creatures of this Class which do not, at least once in their life, give proofs of this natural power of construction; either, as the Cloth-Moth and Water-Moth, form a habitation in their incomplete and larva state; or, like others, spin and prepare a receptacle to contain them during their metamorphosis and death-like sleep; or like the Lion-Ant, dig pits; and like the spider, weave webs for their prey; or like many Species of the Genus *Dyticus*, and some Spiders, form bags or nets for the security of their posterity, and in which they deposit their eggs. Many of those which live in communities, build common residences, by their united powers, and under the guidance of an extremely regular, geometrical, innate Instinct.

§ 133. As to the kind of nourishment in Insects, it is easy to see that it is not, as in most red-blooded animals, calculated merely for the preservation of the individual, but more particularly for the purpose of *consuming* organized matter. Insects must eat, not solely to satisfy hunger, but also to destroy carrion, to annihilate other Insects, to extirpate weeds, &c.—An admirable provision, to the execution of which, besides the almost incalculable number of Species, the extremely rapid multiplication of many, the unexampled voracity of others, and the quickness with which digestion is carried on in their

very short intestinal canal, all tend to contribute. Thus it is known that a Caterpillar will in twenty-four hours consume more than three times its own weight.—The organs of 'mastication in Insects are more diversified than in any other Class of animals: many are provided with jaws, having teeth and moving laterally; others, with a horny, pointed snout, (*rostrum*) for boring; others with a fleshy snout having a wide opening, (*proboscis*); and others with a tongue, so called, rolled into a spiral shape.

§ 134. Some Insects are secured from the attacks of their enemies by their deceptive form; others by having the same colour as the plants on which they live*, and consequently being less readily noticed; others, by the powerful smell which they can diffuse in case of necessity; others by their social mode of life; others again by their astonishing strength, &c. Many are provided with weapons, as horns like forceps or nippers, or with stings and venom.

§ 135. In the mode of propagation of Insects there are also many peculiarities. Thus the two sexes in one and the same Species are often so extremely different in form that they seem like animals of distinct kinds: in Bees, and many similar Insects, the greater number is without sex; that is to say, they are themselves produced without being destined in the ordinary course of nature for generation or impregnation.

§ 136. This peculiarity extends in different Insects to the mode of copulation. In not a few Species, for instance, it is effected in flying, and many possess wings only during the short season of breeding. In general, the greater number live in a state of compulsory monogamy, inasmuch as they are incapable of copulating more than once in the course of life: death is with them so inevitable a result of their first copulation, that life may be prolonged by delaying the period of sexual connection.

§ 137. Among other peculiarities of the business of propagation in Insects, many, as the Cochineal-worm, the Land-flea, become of an enormous size during pregnancy: thus, in the White Ant, it has been calculated that the abdomen of the female, when about to lay her eggs, is 2000 times larger than previous to impregnation.

* See some remarkable instances in ABBOT'S *Lepidopterous Insects of Georgia*. Vol. I. Tab. 5. Vol. II. Tab. 99.

§ 138. Most Insects lay eggs, which the mother, by a truly wonderful instinct, always deposits precisely in the situations best adapted for the future progeny. Many, for instance, lay their eggs in the bodies of living insects of other kinds, as in Caterpillars, Pupæ, &c. ; or even in the eggs of other kinds of Insects. The eggs of Insects are occasionally, particularly among Butterflies, of very various and remarkable form and appearance, and when deposited by the mother in the open air, are covered with a kind of varnish, protecting them from the destructive influence of rain and other accidents. Some few Insects are viviparous, and many, as the Plant-lice (Aphides), propagate in both ways.

§ 139. A very remarkable phenomenon, almost confined to this Class of animals, or at least much less striking in the others, (Remark on § 72.—§ 94.—§ 116.) is their metamorphosis. There is not any winged Insect which escapes from the egg as such, but all, as well as many Insects which have not wings, must first undergo a kind of change at certain periods of their existence. By this, not only their external form, but also at the same time their internal structure, contrary to common opinion, is altered in a certain degree*, a circumstance which by no means coincides with the supposed pre-existence of pre-formed germs. (§ 7.)

Remark. If the Moth existed already formed in the Caterpillar, we should at least expect that similar Moths should be produced by similar Caterpillars. But many American Caterpillars, which resemble European ones in the closest manner possible, give origin to Moths having totally different forms :—and on the other hand, many remarkably similar Moths of both these parts of the World, are developed from Caterpillars altogether unlike. See Sir J. E. SMITH, in ABBOT'S work quoted above, Vol. I. p. 5. and PROF. HEROLD'S *Entwickelungs-Geschichte der Schmetterlinge*. Marb., 1815. 4to. with 33 plates.—p. 115, &c.

§ 140. Insects which undergo metamorphosis are called *Larvæ*, whilst in the state in which they escape from the egg. They are mostly very small on their first appearance, so that a full grown Caterpillar of the Willow-Moth for instance, is 72,000 times heavier than when it issues from the egg. On the other hand, they grow with great rapidity, so that as an

* LYONET, *Chenille de Saule*, p. 585, &c.

example, the Maggot of the Meat-fly, at the end of twenty-four hours, is 155 times heavier than at its birth. Some Larvæ have feet, as Caterpillars and the Grubs of Chafers; others have not, as Maggots: none have wings. In this state also they are incapable of propagating; they merely feed, increase, and change their covering several times.

§ 142. The form into which the Larva is converted is called Nympha. Many can move about and take food when in this state. Others, on the contrary, are covered up, as Pupæ (*Chrysalis*, *Aurelia*), and pass this portion of their life in a state of torpor without eating or moving.

§ 141. During the time, however, that the creature thus lies insensible and torpid within its coverings, a great change is going forward, by which it quits the larva-state, and is enabled to leave its prison as a perfect Insect. (*Insectum declaratum*, *imago*.) Many Insects finish this last portion of their existence in a very short time. Several, when they break from the coverings of the larva-state are unprovided with a mouth, and cease to eat or grow. These two functions of all organized bodies they performed while *larvæ*; a third only remains—to propagate the Species, and then to give way to their posterity and perish.

§ 143. The immediate utility* of Insects to man, is but limited; but, on the other hand, the parts which these small and unnoticed animals perform in the general economy of nature, is in an equal degree varied and incalculable. Some destroy numerous kinds of weeds in the bud, or extirpate them when full grown. Another extremely useful object is effected by many Insects which feed on carrion, live in dung, &c., and by that means destroy, disperse and change noxious animal substances; on the one hand, obviating the infection of the air, and on the other, promoting the fertilization of the earth. It is in this way, for instance, that flies are so serviceable in warm climates. So again, there are innumerable Insects which effect the impregnation of plants in a very remarkable manner, as a Species of *Cynips* is employed for the artificial fructification of the fig. Various kinds of Insects are used as baits for fishing. Many animals of this Class, as Crabs and some kinds of Locusts are eatable. So also is the honey of Bees, from which mead is prepared in many parts of Europe and Africa. Silk

* KIRBY and SPENCE. Vol. I. p. 250, &c.

is employed for clothing and many other purposes. Several Insects afford excellent dyes, as Cochineal, &c. Galls are employed for ink,—wax for lights, and other purposes. Lac, which is the product of certain Indian Species of *Coccus*, is employed to make varnish, sealing-wax, &c. As medicines, we have Spanish Flies, Wood-lice, Ants—the Oil-beetle, recommended in hydrophobia, and many beetles for relieving toothache.

§ 144. Great as is the utility of Insects, the injury done by many is also very considerable. Many are noxious to the products of the earth in general, cause scarcity, or as Locusts, destroy every thing in their course. Some are especially injurious to corn; others, as Caterpillars, Grubs, &c. to garden-plants, or fruit-trees; the various Species of *Coccus*, to orange-trees in particular; the Larvæ of some Species of *Dermestes*, &c. to forest trees; Ants, &c. to meadows; Cock-roaches, to victuals; the White Ants, &c. to furniture; Moths to woollen goods, fur, &c.; the Larvæ of many small Insects, to books, collections of natural history, &c. Lastly, some kinds of vermin infest man, horses, sheep, fowls, other domestic animals, and even other serviceable Insects, as Bees, Silk-worms. Others again, as Scorpions, are formidable by their venom.

§ 145. In the systematic arrangement of this class, I follow the method of Linnæus; the nature of this Manual, composed with relation to my Annual Lectures on the whole of Natural History, not admitting any other.

Order I. COLEOPTERA. Beetles. *Ger.* Käfer. Mostly with horny bodies. In a state of rest, the wings fold together, and are provided with two horny coverings or sheaths, which meet in a straight line in the middle.

II. HEMIPTERA. With four wings folded together crucially or longitudinally, hard for one half, and almost like parchment. Sometimes with forceps or nippers for eating, sometimes with a pointed proboscis.

III. LEPIDOPTERA. Butterflies. With soft, hairy bodies, and four expanded wings, covered with coloured scales.

IV. NEUROPTERA. With four transparent, net-shaped, or lattice-like wings.

V. HYMENOPTERA. With four transparent veined wings.

VI. DIPTERA. Insects with two wings (uncovered.)

VII. APTEA. Insects without wings.

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I. COLEOPTERA, sive Vaginipennia. (Eleutherata. FABR.)

The animals of this Order* in general, are called Beetles, although this name is more strictly applicable to the first Genus. The Larva has nippers, and in most Genera, six legs attached to the thorax ; in some, as the *Cerambyces*, it is without feet (Maggots.) It generally becomes a Chrysalis underground, in an excavated cell ; or, as in the *Cerambyces*, already mentioned, in wood. The perfect insect is at first very soft, but soon becomes hard after exposure to the air ; it, as well as the Larva, has jaws on the head, and possesses a hard, horny covering for the wings (*Elytra*).

1. SCARABÆUS. Beetle. Ger. Käfer. Fr. Hanneton.—Antennæ clavatæ capitulo fissili, tibiæ anticæ sæpius dentatæ.

1. *Hercules*. (*Geotrupes Hercules* FAB.)—S. Scutellatus, thoracis cornu incurvo maximo ; subtus unidentato, capitis recurvato ; supra multidentato.

(RÖSEL. Vol. IV. Tab. 5. fig. 3.)

In Brazil. The Larva is full as thick as a thumb. The Beetle varies in colour, but is mostly brown, green, &c.

* J. E. VOET, *Catalogue Systematique des Coleopteres*. A la Haye, 1766. 4to. G. A. OLIVIER, *Entomologia*. Paris, from 1789. 4to. and the *German Translation with Notes and Additions*. By K. ILLIGER. Braunschw. from 1800. 4to.—J. CH. FABRICII, *Systema Eleutheratorum*. Kil., 1801. 2 Vols. 8vo.

2. *Actæon*. (Geotrupes *A.*—F.) *S. scutellatus* thorace bicorni, capitis cornu unidentato, apice bifido.

(RÖSEL. Vol. II. *Erdkäf.* 1. Tab. A. fig. 2.)

In the same country as the above.

3. *Lunaris*. (Coprís *Lun.*—F.) *S. exscutellatus*, thorace tricorni; intermedio obtuso bifido, capitis cornu erecto clypeo emarginato.

(FRISCH, p. 4. Tab. 7.)

In meadows, pastures, &c. and particularly in cow-dung, from which, like other similar Species of Beetles, it forms hollow balls, which it attaches under ground to the roots of grass, &c. and employs as receptacles for its eggs, one in each.

4. *Nasicornis*. (Geotrupes *N.*—FAB.) *S. scutellatus*, thorace prominentia triplici, capitis cornu incurvato, antennis heptaphyllis.

(RÖSEL. Vol. II. *Erdkäf.* 1. Tab. 7. fig. 8, 10.)

The largest Beetle of these climates; it seldom flies. In the Larva state it is found in tan and hollow trees. In many places it is very injurious to the vines.

5. *Sacer*. (Ateuchus *S.*—FAB.) *S. exscutellatus*, clypeo sexdentato, thorace inermi crenulato, tibiis posticis ciliatis, vertice subidentato.

(SULZER'S *Gesch.* Tab. 1. fig. 3.)

Very common in Egypt, by the ancient inhabitants of which country, it was worshipped as the most sacred of their mystic symbols, as the representation of the upper and lower worlds, and represented on their obelisks, their Sarcophagi, and various other works of art*. It is found, in particular, represented on the posterior part of the Egyptian and Etruscan carved stones, which, on that account, have been called *Scarabæi*.

6. *Fimetarius*. (Aphodius *F.*—FAB.) *S. Scutellatus*, thorace inermi, capite tuberculato, elytris rubris, corpore nigro.

(FRISCH. p. 4. Tab. 19. fig. 3.)

In Cow-dung.

7. *Stercorarius*. The Dung-beetle. *Ger.* der Rosskäfer.—*S. scutellatus*, muticus, ater, glaber; elytris sulcatis; capite rhombeo; vertice prominulo; antennis rubris.

(FRISCH. p. 4. Tab. 6. fig. 3.)

Particularly in horse-dung, and therefore very common in

* G. ZOEGA de Orig. et Usu Obelissorum. p. 446, &c.

roads. Its flying about on Summer evenings, is considered a sign that the following day will be fine.

8. *Vernalis*.—*Ger.* der Mistkäfer.—*S.* *scutellatus muticus*, elytris glabris lævissimis, capitis clypeo rhombeo, vertice prominulo, antennis nigris.

(SULZER'S *Gesch.* Tab. 1. fig. 6.)

Very common in sheep-dung.

9. *Horticola*. (*Melolontha H.*—*F.*) The Garden-beetle. *Ger.* der Garten-käfer.—*S.* *scutellatus muticus*, capite thoraceque cæruleo subpiloso, elitris griseis, pedibus nigris.

(FRISCH. p. 4. Tab. 14.)

Principally on fruit-trees.

10. *Melolontha*. (*Melolontha vulgaris*.—*F.*) The Cock-chaffer, May-chaffer. *Ger.* der Maykäfer, Kreutzkäfer. *Fr.* le Hanneton.—*S.* *scutellatus muticus testaceus*, thorace villosa; cauda inflexa, incisuris abdominis albis.

(RÖSEL. Vol. II. *Erdkäf.* 1. Tab. 1.)

One of the commonest Insects; whilst in the larva state, lasting four years, feeds on the roots of corn, &c., and has occasionally produced extensive scarcity *. It at last makes its appearance as the Cock-chaffer, and in this form injures the young foliage of fruit trees in particular.

11. *Solstitialis*. (*Melolontha S.*—*F.*)—*S.* *scutellatus muticus testaceus*, thorace villosa, elytris luteo-pallidis pellucidis; lineis tribus albis parallelis.

(FRISCH. p. 9. Tab. 15. fig. 3.)

This Beetle, also, while in the larva state, is very injurious to corn.

12. *Auratus*. (*Cetonia aurata*. *F.*) The Rose-chaffer. *Ger.* der Goldkäfer.—*S.* *scutellatus muticus auratus*, segmento abdominis primo lateribus unidentato, clypeo planiusculo.

(FRISCH. p. 12. Tab. 3. fig. 1.)

The larva and Chrysalis are very commonly found in Ant-hills and hollow trees; the Beetle itself in gardens, &c. There have been instances in which it has been kept alive more than eight years, by being fed on crusts of bread soaked in water.

* As for instance, in 1479, when this Insect was cited by a regular *Monitorium* before the Spiritual Court of Lausanne, who assigned it an Advocate from Friburg; but after an attentive hearing of both parties, and mature deliberation, concluded by placing it under a *Ban*.—See M. STETTLER'S *Schweitzer-Chronic.* s. 278. u. f.

2. *LUCANUS*. Antennæ clavatæ; clava compressa latere latiore pectinato fissili. Maxillæ porrectæ, exsertæ, dentatæ.

1. *Cervus*. The Stag-beetle. *Ger.* der Hirschkäfer. *Fr.* le Cerf volant.—*L.* scutellatus; maxillis exsertis, apice befurcatis, latere unidentatis.

(RÖSEL. Vol. II. *Erdkäf.* 1. Tab. 3.)

Next to Crabs, &c.; is one of the largest European Insects: it lives chiefly in oak forests. It is only the male which has forceps on the head resembling the antlers of the Stag.

3. *DERMESTES*. Antennæ clavatæ; capitulo perfoliato; articulis tribus crassioribus. Thorax convexus, vix marginatus. Caput sub thorace inflexum latens.

1. *Lardarius*. *D.* niger elytris antice cinereis, punctis nigris. (FRISCH. p. 5. Tab. 9.)

Both Larva and Beetle feed on the fat and soft parts of dead animals.

2. *Pellio*.—*D.* niger coleoptris punctis albis binis.

Injurious to furs, stuffed animals, &c.

3. *Typographus*. (*Bostrichus Typ.*—FAB.) *Ger.* der Borkenkäfer.—*D.* testaceus pilosus elytris striatis retusis præmorso dentatis.

(TREBRA in *Schr. der Berl. Ges. Naturforsch. Freunde.* B. 4. Tab. 4.)

The animal which has recently become so formidable to the Pine forests on the Harz and other parts of Germany; and which lodges in such numbers in the Alburnum of the *Pinus abies*, that as many as 80,000 of its Larvæ have been counted in a tree of moderate size. This affection (*Wurmtröckniss.* *Ger.*) causes the tree to perish from the summit downwards, its leaves turn red, it loses its resin, and is rendered nearly unfit even for making charcoal, much less timber or fire-wood*.

4. *Piniperda*. (*Hylesinus Pinip.*—F.) *Ger.* der Tannenkäfer.—*D.* niger subvillosus, elytris piceis integris, plantis rufis.

Scarcely half as large as the last Species.

* This, or a similar Insect, has been stated to produce lately, the same mischief among some of the finest trees in St. James' and the Green Park, London, although the cause was, for some time, totally unsuspected.

5. *Paniceus*. (*Anobium Pan.*—F.) *D. oblongus*, ferrugineus, oculis rufis.

(FRISCH. p. 1. Tab. 8.)

The Larva destroys bread, and is therefore very dangerous to ship biscuit in long sea voyages: it is also one of the most destructive book-worms.

4. *PTINUS*. (*Ger. Kümmelkäfer. Fr. Vrilette.*) *Antennæ filiformes*: *articulis ultimis majoribus*. *Thorax subrotundus*, *immarginatus*, *caput excipiens*.

1. *Pertinax*. (*Anobium Pert.* FAB.) *P. fuscus*, unicolor.

It has its name from the circumstance that when touched it extends its feet and lies as though dead, from which state it cannot easily be made to move.

2. *Fur.*—*P. testaceus*, subopterus, thorace quadridentato, elytris fasciis duabus albis.

(SULZER'S *Gesch.* Tab. 2. fig. 8.)

One of the most injurious animals to collections of Natural History, furniture, furs, &c.

3. *Fatidicus*. (*Anobium tessellatum.*—FAB.) The Death-watch. *Ger. die Todtenuhr.*—*P. fuscus subpilosus griseo irregulariter maculosus*.

(*Phil. Trans.* No. 271, 291.)

One of the very different kinds of Insects which have given origin to a variety of popular fables, by the ticking noises which the sexes make at the time of connexion.

5. *HISTUR*. *Antennæ capitata capitulo solidiusculo*; *infimo articulo compresso, decurvato*. *Caput intra corpus retractile*. *Os forcipatum*. *Elytra corpore breviora*. *Tibiæ anticæ dentatæ*.

1. *Unicolor.*—*H. totus ater*, elytris substriatis.

(SULZER'S *Kennz.* Tab. 2. fig. 8, 9.)

In sandy ground and pasture lands.

6. *GYRINUS*. *Antennæ clavatæ, rigidæ, capite breviores*, *oculi 4, duobus supra, duobus infra*.

1. *Natator.*—*G. substriatus*.

(SULZER'S. *Gesch.* Tab. 2. fig. 10.)

Swims with great velocity on the surface of the water. In diving, it has a bladder of air behind. It has an offensive odour.

7. *BYRRHUS*. *Antennæ clavatæ subsolidæ, subcompressæ*.

1. *Museum.* (*Anthenus Mus.*—F.) *B. nebulosus*, elytris subnebulosis puncto albo.

In peltry, stuffed animals, &c.

8. *SILPHA*. Antennæ extrorsum crassiores. Elytra marginata. Caput prominens. Thorax planiusculus, marginatus.

1. *Vespillo*. (Necrophorus *Ves.*—FAB.) The Carrion Beetle. Ger. der Todtengräber. Fr. le Fossoyeur.—S. oblonga atra, clypeo orbiculato inæquali, elytris fascia duplici aurantia.

(FRISCH. p. 12. Tab. 3. fig. 2.)

It has its name from the dexterity with which it scents from a distance the bodies of small animals, as moles, frogs, &c., and buries them under ground, for the purpose of depositing its eggs. Six of them will bury a mole a foot deep in less than four hours.

9. *CASSIDA*. Antennæ subfiliformes, extrorsum crassiores. Elytra marginata. Caput sub thoracis clypeo plano reconditum.

1. *Viridis*. The Tortoise Beetle.—C. viridis, corpore nigro. (RÖSEL. Vol. II. *Erdkäf.* 3. Tab. 5.)

On thistles, &c. The Larva and Chrysalis are flat, and notched and pointed at the edges.

2. *Murraea*.—C. nigra, clypeo rubro, elytris sanguineis, punctis nigris sparsis.

Very abundant on the Elecampane.

10. *COCCINELLA*. Lady-cow. Lady-bird. Ger. Sonnenkäfer, Marienkuh, Gottes-lämmchen. Fr. Vache à Dieu, Bête de la vierge.—Antennæ subclavatae, truncatae. Palpi clava semicordata. Corpus hemisphaericum, thorace elytrisque emarginatis, abdomine, plano.

1. *Septem-punctata*.—C. coleopteris rubris; punctis nigris septem.

(FRISCH. p. 4. Tab. 1. fig. 4.)

It, as well as some Species of Meloë, has been recommended as a remedy for toothache.

2. *Bipustulata*.—C. coleopteris nigris; punctis rubris duobus, abdomine sanguineo.

(FRISCH. p. 9. Tab. 16. fig. 6.)

11. *CHRYSOMELA*. Antennæ moniliformes, extrorsum crassiores. Thorax, nec elytra, marginatus.

1. *Goettingensis*. (Chrysomela *hæmoptera*.—F.) C. ovata atra pedibus violaceis.

(PANZER. *Faun. Germ. H.* 44. Tab. 3.)

Very common on the plant Yarrow *.

2. *Minutissima*.—*C. ovata nigra opaca*.

One of the smallest Beetles. It is scarcely one third as large as a Flea.

3. *Cerealis*.—*C. ovata aurata*, thorace lineis tribus, coleoptris quinque violaceis, abdomine violaceo.

4. *Oleracea*. (*Galleruca oleracea*. FAB.) *C. saltatoria* (s. femoribus posticis crassissimis) virescenti-cærulea.

A troublesome little animal, which, with several similar Species, are known under the name of Ground-fleas or flies.

5. *Merdigera*. (*Lema merd.*—F.) *C. oblonga rubra*, thorace cylindrico utrinque impresso.

(SULZER'S *Gesch.* Tab. 3. fig. 14.)

In Lilies, Lily of the Valley, &c: The Larva covers itself with its own excrement. The little red Beetle, into which it changes, makes a clear penetrating sound with its wing-coverings, when held in the hollow of the hand, near the ear.

12. *HISPA*. Antennæ fusiformes, basi approximatae, inter oculos sitæ. Thorax elytraque aculeata sæpius.

1. *Atra*.—*H. corpore toto atro*.

Under ground, about the roots of grass.

13. *BRUCHUS*. Antennæ filiformes, sensim crassiores.

1. *Pisi*. The Seed-Beetle. *Ger. der Erbsenkäfer*.—*B. elytris albo punctatis, podice albo maculis binis nigris*.

Is very injurious to the Maze fields in North America.

2. *Nucleorum*.—*B. cinereus*, elytris striatis, femoribus posticis ovatis, dentatis, tibiis incurvis.

(*Mem. de l'Acad. des Sc. de Paris* 1771. Tab. 2.)

In the central parts of America. Almost as large as *Scarabæus auratus*, but often confounded with *Bruchus bactris*, which is much smaller. It bores through the nut-shells of the *Cocos lapidea*, which are as thick as a thumb, hard as a stone, and often cut or turned into buttons, &c.

14. *CURCULIO*. Weevil. *Ger. Rüsselkäfer. Fr. Charançon*. Antennæ sub-clavatae, rostro insidentes. Rostrum corneum prominens.

They have, for the most part, a short, round, but hard, body, covered with a shell-like armour, together with a solid snout,

* See VOIGT'S *Neues Magazin*. B 11. S. 201, for PROFESSOR GRAVENHORST'S critical determination of this Species, so often mistaken and confounded with others.

more or less curved, and of various lengths. They are noxious animals, of which those with very long snouts attack trees, and the others grain and garden plants.

1. *Palmarum*. (*Calandra palm.*—FAB.) *C. longiroster ater*, thorace ovato planiusculo, elytris abbreviatis striatis.

(SULZER's *Kennz.* Tab. 3. fig. 20.)

Principally in the South of India. Is about the size of the Stag-Beetle. The Larva feeds on the pith of the Sago, and is itself eaten as a delicacy.

2. *Frumentarius*. (*Atelabus frum.*—FAB.) The Corn-weevil.

Ger. der schwarze Kornwurm.—*C. longirostris sanguineus*.

Of great injury to granaries. It extracts the flour from corn, and leaves the husk behind. The most certain remedy is to sprinkle the floors, &c., with a strong alkaline ley. It not unfrequently spreads itself into chambers, beds, &c.

3. *Granarius*. (*Calandra granaria*. F.) *C. longiroster*, piceus oblongus thorace punctato longitudine elytrorum.

Also in granaries, mills, &c.

4. *Paraplecticus*. (*Lixus paraplec.* F.) *C. longiroster cylindricus subcinereus*, elytris mucronatis.

(SULZER's *Gesch.* Tab. 4. fig. 7.)

On aquatic plants. The idea that it causes paralysis in horses is unfounded, but may apply to the plants on which it lives.

5. *Bacchus*. (*Atelabus B.*—FAB.) The Vine-weevil. *Ger.* der Rebenstecher.—*C. longiroster aureus*, rostro plantisque nigris.

(SULZER's *Gesch.* Vol. IV. fig. 4.)

On Apple-trees, vines, &c.

6. *Pomorum*. — *C. longirostris femoribus anticis dentatis*, corpore griseo nebuloso.

(FRISCH. p. 1. Tab. 8.)

In some years destroys almost all the apple-buds.

7. *Nucum*. (*Rhynchænus nucum*. F.) The Nut-weevil.—*C. longiroster*, femoribus dentatis, corpore griseo longitudine rostri.

(RÖSEL. Vol. III. *Erdkäf.* 4. Tab. 67.)

Perforates the Hazel-nut.

8. *Imperialis*. The Diamond-beetle. *Ger.* der Juwelenkäfer.—

C. breviroster niger, elytris dentatis, sulcatis punctis excavatis, auro versicolore distinctis, abdomine æneo viridi.

In Brazil. One of the most splendid Insects. The gold and

colours in the numerous pits marked in rows upon the wing coverings, give it an inexpressibly fine appearance in a clear light, and particularly under a magnifying glass.

15. *ATTELABUS*. Caput postice attenuatum inclinatum.

Antennæ apicem versus crassiores.

1. *Coryli*. The Nut-beetle.—*A. niger*, elytris rubris.

(SULZER'S *Kennz.* Tab. 4. fig. 25.)

2. *Apiarius*. (*Trichodes ap.*—F.) *Ger. der Immenwolf.*—*A. cærulescens*, elytris rubris, faciis tribus nigris.

(SULZER'S *Gesch.* Tab. 4. fig. 4.)

Very common where Bees are kept, and often does them much injury.

16. *CERAMBYX*. (*Capricornus*.) Antennæ attenuatæ.

Thorax spinosus aut gibbus. Elytra linearia.

Many of the Species have remarkably long Antennæ, and very strong corslet and wing-coverings, and are so tenacious of life that they have been known to live a month after being transfixed with a pin. They mostly live in wood, and make a rattling noise by rubbing the corslet against the wing-coverings.

1. *Longimanus*.—*C. thorace spinis mobilibus*, elytris basi unidentatis apiceque bidentatis, antennis longis.

(RÖSEL. Vol. II. *Erdkäf.* 2. Tab. 1. fig. a.)

As well as the following Species, in South America.

2. *Cervicornus*. (*Prionus C.*—F.) *C. thorace marginato dentato*, maxillis porrectis coniformibus utrinque spinosis, antennis brevibus.

(RÖSEL. 1. cit. fig. b.)

Larger than the former. It is beautifully marked and has forceps, like the Stag-beetle.

3. *Moschatus*.—*C. thorace spinoso*, elytris obtusis viridibus nitentibus, femoribus muticis, antennis mediocribus.

(FRISCH. p. 13. Tab. 11.)

It has a musky smell.

4. *Ædilis*. (*Lamia Æ.*—FAB.) *C. thorace spinoso*; punctis 4 luteis, elytris obtusis nebulosis, antennis longissimis.

(FRISCH. p. 13. Tab. 12.)

The Antennæ are full six times as long as the rest of the animal.

17. *LEPTURA*. Antennæ setacæ. Elytra apicem versus attenuata. Thorax teretiusculus.

1. *Aquatica*. (*Donacia crassipes*.—F.) The Wood-beetle.—*L. deaurata*, antennis nigris, femoribus posticis dentatis. On aquatic plants of all kinds. Its colour is various.

18. *NECYDALIS*. *Ger.* Afterholzbock.—*Antennæ setaceæ*.
Elytris alis menora. *Cauda simplex*.

1. *Major*. (*Molorchus abbreviatus*.—F.) *N. elytris abbreviatis ferrugineis immaculatis*, antennis brevioribus.

19. *LAMPYRIS*. (*Cicindela, nitedula*.) Glow-worm. *Ger.* Johannswürmchen. *Fr.* Ver luisant.—*Antennæ filiformes*. *Elytra flexilia*. *Thorax planus*, semiorbiculatus, caput subtus occultans cingensque. *Abdominis latera plicato-papillosa*.

The male only is winged, and has two spots of bluish phosphorescent light on the belly. The female is without wings, but shines more vividly than the males, particularly at the season of copulation, whence it is probable that this light serves the purpose of directing the male to her. Some time after the female has laid her eggs, which also shine in the dark, this light disappears in both sexes.

1. *Noctiluca*.—*L. oblonga fusca*, clypeo cinereo.

Under Juniper, Rose-bushes, &c. Two placed in a glass give sufficient light for reading by.

20. *CANTHARIS*. *Antennæ setaceæ*. *Thorax marginatus capite brevior*. *Elytra flexilia*. *Abdominis latera plicato-papillosa*.

1. *Fusca*.—*C. thorace marginato rubro*, macula nigra, *elytris fuscis*.

The Larva of this Insect lives under ground during Winter, and sometimes after snow makes its appearance in thousands, a circumstance which has given rise to many fables.

21. *ELATER*. Skipper. *Ger.* Springkäfer. *Fr.* Taupin.—*Antennæ setaceæ*. *Thorax retrorsum angulatus*. *Mucro pectoris e foramine abdominis resiliens*.

These animals are remarkable for the singular dexterity with which, when lying on their backs, they throw themselves into the air and fall on their feet. This is principally effected by a long process attached to the front of the thorax, and moving in a groove along the belly, from which it is forcibly protruded in making the dart upwards, and also by the points which project backwards upon both sides of the corslet, and are articulated in a similar manner with the wing-coverings.

1. *Noctilucus*.—*E. thoracis lateribus macula flava glabra*. In the equatorial parts of America. It is full two inches long. The two round yellow spots near the lateral points of the corslet, shine vividly in the dark : on that account, this and some other phosphorescent Insects, were formerly used by the Caribs for lamps.

2. *Niger*.—*E. thorace lævi, elytris, pedibus, corporeque nigris*.

Very common in the pastures of Europe.

22. *CICINDELA*. *Antennæ setaceæ. Maxillæ prominentes denticulatæ. Oculi prominuli. Thorax rotundato-marginatus.*

Whilst in the Larva state, they bury themselves in sand like the Ant-lion, to ensnare other Insects ; and, as Beetles, pursue them either running or flying with great velocity.

1. *Germanica*.—*C. viridis, elytris puncto lunulaque apicem albis*.

23. *BUPRESTIS*. *Antennæ setaceæ, longitudine thoracis ; caput dimidium intra thoracem retractum.*

1. *Gigantea*.—*B. elytris fastigiatis bidentatis rugosis, thorace marginato lævi, corpore inaurato.*

(SULZER'S *Kennz.* Tab. 6. fig. 38.)

In the East and West Indies. As long as a finger.

2. *Chrysostigma*.—*B. elytris serratis longitudinaliter, sulcatis, maculis duabus aureis impressis, thorace punctato.*

(SULZER'S *Kennz.* Tab. 6. fig. 39.)

3. *Viridis*.—*B. elytris integerrimis sublinearibus punctatis, thorace deflexo, viridi elongato.*

Of the colour of the Spanish Fly, but only two lines long. A few years since, the Larva did much harm among the young beech-trees here, (Göttingen) by eating serpentine excavations, and in that way destroying the alburnum.

24. *DYTICUS*. (*Hydrocantharus*.) Water-beetle. *Ger. Wasserkäfer. Antennæ setaceæ aut clavato-perfoliatæ. Pedes postici villosi, natatorii submutici.*

1. *Piceus*. (*Hydrophilus P.—F.*) *D. antennis perfoliatis, corpore lævi, sterno carinato, postice spinoso.*

(FRISCH. p. 2. Tab. 6. fig. 1.)

One of the largest species. When the Beetle is about to lay its eggs, it prepares a neat oblong husk or shell, which it covers with a brown silk, and which floats like a boat on the water, with the eggs inclosed, until such time as the young

Larvæ are hatched, and able to leap overboard into their element.

2. *Marginalis*.—*D. niger*, thoracis elytrorumque margine flavis (mas.)

(SULZER's *Kennz.* Tab. 6. fig. 42.)

Is injurious to fish-ponds, as are, probably, most other Species of the Genus. In the female, the anterior half of the wing-coverings is longitudinally furcated.

25. *CARABUS*. Antennæ setacæ. Thorax obcordatus apice truncatus marginatus. Elytra marginata.

Rapacious animals. Many, when touched, effuse a stinking fluid. Few of them fly, but run with great rapidity.

1. *Coriaceus*.—*C. apterus ater opacus*, elytris punctis intricatis subrugosis.

(SULZER's *Kennz.* Tab. 6. fig. 44.)

2. *Auratus*.—*C. apterus*, elytris porcatis; striis sulcisque lævibus inauratis.

Very common in pastures and meadows.

3. *Sycophanta*. (*Calosoma* S.—F.) *C. aureo nitens*, thorace cæruleo, elytris aureo viridibus striatis, abdomine subatro.

(SULZER's *Gesch.* Tab. 7. fig. 1.)

One of the largest European Species of the Genus.

4. *Crepitans*. (*Brachinus* *Crep.* F.) The Bombardier. *Ger.* der Bombardirikäfer. *Fr.* le Petard. *Swed.* Styckjunkare.—*C. thorace capite pedibusque ferrugineis*, elytris viridi nigricantibus.

(*Sched.* *Abhandl.* 1750. Tab. 7. fig. 2.)

A small Species, which is attacked by the preceding one. Dr. ROLANDER has described the peculiar way in which it defends itself from the *C. sycophanta*, *C. inquisitor*, and other enemies, viz. by ejecting a bluish vapour with a tolerably loud report: Hence the name Bombardier.

5. *Spinipes*. (*C. gibbus*.—F.) *C. piceus*, thorace linea excavata longitudinali, manibus spinosis.

(OLIVIER. T. 3. Tab. 12. fig. 142.)

The subterraneous Larva has caused a complete failure of the seed-corn in certain years, as in Lombardy 1776, and the district of Halle in 1812. The Beetle rests at night in great numbers on the ears of corn.

26. *TENEBRIO*. Antennæ moniliformes articulo ultimo subrotundo. Thorax plano-convexus, marginatus. Caput exsertum. Elytra rigidiuscula.

1. *Molitor*. The Mealworm-beetle.—*T. alatus niger totus, femoribus anticis crassioribus.*

(FRISCH. p. 3. Tab. 1.)

The Larvæ live in flour, are therefore common in mills and bakehouses, and are used for feeding nightingales.

2. *Mortisagus*. (*Blaps Mortisaga*,—F.) *Ger. der Todtenkäfer.*
—*T. apterus thorace æquali, coleoptris lævibus mucronatis.*

(FRISCH. p. 13. Tab. 25.)

27. MELOE. *Antennæ moniliformes articulo ultimo ovato. Thorax subrotundus. Elytra mollia flexilia, caput inflexum gibbum.*

1. *Proscarabæus*. The Oil-beetle. *Ger. der Maywurm. Fr. le Scarabée onctueux.*—*M. apterus, corpore violaceo.*

(FRISCH. p. 6. Tab. 6. fig. 5.)

A soft animal, which exudes a stinking fluid from the knee-joints, as soon as it is touched.

2. *Vesicatorius*. (*Lytta vesicatoria*. FAB.) *Cantharis officinalis.*
Blistering Fly.—*M. alatus viridissimus nitens, antennis nigris.*

The valuable animal employed in medicine for raising blisters.

28. MORDELLA. *Antennæ filiformes serratæ. Caput deflexum sub collo (in territo.) Palpi compresso-clavati, oblique truncati. Elytra deorsum curva apicem versus. Ante femora lamina lata ad basin abdominis.*

Very small Beetles. The Genus includes but few Species, and even these do not seem to multiply rapidly.

1. *Aculeata*. *M. atra, ano spina terminata.*

(SULZER'S *Kennz.* Tab. 7. fig. 46.)

29. STAPHYLINUS*. *Antennæ moniliformes. Elytra dimidiata. Alæ tectæ. Cauda simplex exserens duas vesiculas oblongas.*

The animals of this Genus are remarkable for the bladders, which, when in danger, they protrude from the posterior part of the body, but for what purpose is unknown.

1. *Maxillosus*. *S. pubescens niger, fasciis cinereis, maxillis longitudine capitis.*

* J. L. C. GRAVENHORST, *coleoptera microptera*, &c. Brunsv. 1802. 8vo.—
EJ. *Monographia coleopterorum micropterorum.* Götting. 1806. 8vo.

30. *FORFICULA*. Antennæ setaceæ. Elytra dimidiata.
Alæ tectæ. Cauda forcipata.

1. *Auricularia*. The Ear-wig. *Ger.* der Ohr-wurm. *Fr.* le Perce-oreille.—*F.* elytris apice albis.

(FRISCH. p. 8. Tab. 15. fig. 1, 2.)

The supposition that this animal penetrates into the ears of men, is unfounded; it may occasionally have been found there, like many other Insects, but nothing more. It is really injurious, however, to tender vegetables, the buds of pinks, and when in great numbers, to the underground timber of houses, and the like.

II. HEMIPTERA. (Ulonata et Rhyngota. FABR.)

In most Insects of this Order, the head is depressed towards the chest; in some is provided with jaws; but in the greater number, with a proboscis bent towards the abdomen, whence they have by many naturalists been called *Proboscidea*. They have generally four wings, of which, the upper, in particular, are horny and firm at the root, thinner and softer at the outer extremity: in some instances they are placed longitudinally, in others folded crosswise: in some cases too, they are provided with wing-coverings. Many have but two wings, and in some, the female is without any. Their metamorphoses are not very striking: the Larva resembles the perfect Insect, except in wanting wings, which are formed by degrees.

31. *BLATTA*. Caput inflexum. Antennæ setaceæ. Elytra alæque planæ, subcoriaceæ. Thorax planiusculus, orbiculatus, marginatus. Pedes cursorii. Cornicula duo supra caudam.

1. *Orientalis*. The Cock-roach. *Ger.* die Brotschabe. *Fr.* le Cancrelas, Ravet.—*B.* ferrugineo-fusca elytris abbreviatis sulco oblongo impresso.

(FRISCH. p. 5. Tab. 3.)

Now found in almost every part of the World. With other Species of the Genus (as *B. Germanica*—*B. Americana*, I know not why so called,) a most troublesome kind of vermin. Attacks food of all kinds, but bread in particular, and hence, may produce extreme distress in long sea-voyages*. It may be extirpated by arsenic, the vapour of sulphur and assafoetida, or

A frightful instance is given by MAURELLE'S South Sea Voyages in *Voyage de LA PEROUSE autour du Monde*. Vol. I. p. 279.

when in small numbers in a room, kitchen, &c. by introducing a duck or hedgehog.

2. *Heteroclita*.—*B. fusca*, elytris nigris, *sinistro* integro 4 pustulato; *dextro* ad marginem internum semipellucido, 3 pustulato.

(PALLAS. *Spicileg. Zoolog.* 9. Tab. 1. fig. 5.)

In Tranquebar, &c. Is remarkable for the dissimilar manner in which the two sides of the wing-coverings are marked.

3. *Laponica*.—*B. flavescens*, elytris nigro-maculatis.

In the temperate parts of Europe as well as Lapland.

32. MANTIS. Caput mutans, maxillosum, palpis instructum. Antennæ setaceæ. Alæ 4 membranaceæ, convolutæ, inferiores plicatæ. Pedes *antici* compressi, subtus serrato-denticulati, armati ungue solitario et digito setaceo laterali articulado: *postici* 4, læves, gressorii. Thorax linearis elongatus angustatus.

All the Species have an uncommon out-stretched form. Their mode of walking, &c. has something solemn in it, that may have given rise to the credulous devotion with which certain Species have been venerated, particularly in the East.

1. *Gigas*. (*Phasma G.*—F*.) *M. thorace* teretiusculo scabro, elytris brevissimis, pedibus spinosis.

(RÖSEL. Vol. II. *Heuschr.* Tab. 19. fig. 9, 10.)

From Amboina. It is a span long, and yet scarce as thick as a goose-quill. It is eaten by the Indians.

2. *Gongylodes*.—*M. thorace* subciliato, femoribus anticis spina terminatis, reliquis lobo.

(RÖSEL. Vol. II. *Heuschr.* Tab. 7. fig. 1, 2, 3.)

From Guinea, &c.

3. *Religiosa*. (*M. oratoria*. var *B.*—F.) The Praying-cricket. *Ger.* die Gottesanbetherin.—*M. thorace* lævi subcarinato elytrisque viridibus immaculatis.

(RÖSEL. Vol. II. *Heuschr.* Tab. 1, 2.)

It mostly goes on four legs, holding up the two fore ones. It is sometimes called the *dried leaf*, from the resemblance of its wing-coverings, in form and colour, to a dry willow-leaf. It may live ten years.

4. *Precaria*.—*M. thorace* subciliato, elytris flavis ocello ferrugineis.

* J. C. FABRICII, *Supplementum Entomologiæ Systematicæ*. Hafniæ. 1798. 8vo. p. 186.

(*Abbild. Nat. Hist. Gegenst. Tab. 88.*)

At the Cape ; and is considered sacred by the Hottentots.

33. *GRYLLUS*. Grasshopper. *Ger.* Heuschrecke. *Fr.* Saute-relle.—Caput inflexum, maxillosum, palpis instructum. Antennæ setaceæ sive filiformes. Alæ 4 deflexæ, convolutæ, inferiores plicatæ. Pedes postici saltatorii. Ungues ubique bini.

An extensive Genus, most Species of which are injurious to meadows and corn-fields. In many the male makes the well-known chirping sound, either at the time of copulation, or at the commencement of night, or change of weather, partly with the legs, but principally with the wings.

1. *Gryllotalpa*. (*Acheta G.—F.*) The Mole-cricket. *Ger.* die Werre. *Fr.* la Courtilière.—G. thorace rotundato, alis caudatis elytro longioribus, pedibus anticis palmatis tomentosis.

(*RÖSEL. Vol. II. Heuschr. Tab. 14, 15.*)

In Europe and North America, and in some districts, as Thuringia, very abundant. Lives chiefly underground, and does great injury to young vegetables and corn.

2. *Domesticus*. (*Acheta D.—F.*) The Cricket. *Ger.* die Grille. *Fr.* le Grillon.—G. thorace rotundato, alis caudatis elytro longioribus, pedibus simplicibus, corpore glauco.

(*RÖSEL. Vol. II. Heuschr. Tab. 12.*)

3. *Campestris*. (*Acheta C.—F.*) The Field-cricket.—G. thorace rotundato, cauda biseta stylo lineari, alis elytro brevioribus, corpore nigro.

(*FRISCH. p. 1. Tab. 1.*)

4. *Viridissimus*. (*Locusta viridissima.—F.*) The Grasshopper. *Ger.* der Baumhüpfer.—G. thorace rotundato, alis viridibus immaculatis, antennis setaceis longissimis.

(*RÖSEL. Vol. II. Heuschr. Tab. 10, 11.*)

Of a beautiful green colour. Lives chiefly among bushes, and can spring to a great distance.

5. *Verrucivorus*. (*Locusta verrucivora.—F.*) G. thorace subquadrato lævi, alis viridibus fusco maculatis, antennis setaceis longitudine corporis.

(*RÖSEL. Vol. II. Heuschr. Tab. 8.*)

6. *Cristatus*. G. thorace cristato, carina quadrifida.

(*RÖSEL. Vol. II. Heuschr. Tab. 5.*)

In the Levant, Egypt, &c.

7. *Migratorius*. The Locust. *Ger.* die Zugheuschrecke.—G.

thorace subcarinato; segmento unico, capite obtuso, maxillis atris.

(*Abbild. Nat. Hist. Gegenst. Tab. 29.*)

The formidable Insect which has sometimes appeared in vast numbers even in Europe, and caused general scarcity and famine. It is originally a native of Asiatic Tartary, but is occasionally found singly in Germany, which, however, has not suffered from its invasions since 1750*. It also exists in North America, unless, indeed, that be a distinct Species. It is a well ascertained fact, that in Arabia and North Africa they are used as food, now as well as in former times: and if some modern travellers have doubted the circumstance, it only affords an instructive instance of over-hasty scepticism.

8. *Stridulus*.—G. thorace subcarinato, alis rubris extimo nigris nebulosis.

(RÖSEL. Vol. II. *Heuschr.* Tab. 21. fig. 1.)

Mostly lives in wood. The male makes a loud rattling noise when flying.

34. *FULGORA* †. Caput fronte producta, inani. Antennæ infra oculos, articulis 2, exteriore globoso. Rostrum inflexum, pedes gressorii.

The remarkable character of this Genus consists in the horny bladder on the forehead, which, in the following Species, diffuses a clear light during life, and some time after death.

1. *Laternaria*. The Lanthorn-fly. *Ger.* der Laterträger. *Fr.* la Porte-lanterne.—F. fronte ovali recta, alis lividis; posticis ocellatis.

(RÖSEL. Vol. II. *Heuschr.* Tab. 28, 29.)

The largest Species. The shining bladder is almost as large as the whole body, and gives such a clear light, that the natives of Guiana use them as lanthorns.

2. *Candelaria*. The Chinese Lanthorn-fly.—F. fronte rostrato-subulata adscendente, elytris viridibus luteo-maculatis: alis flavis, apice nigris.

* In addition to the usual sources, consult on the history of this Insect—JOEL *neu übersetzt und erläutert* von C. W. JUSTI., Leipzig, 1792. 8vo. and J. BRYANT'S *Observations upon the Plagues inflicted upon the Egyptians*. London, 1794. 8vo.

† On this, and the four following Genera, consult *Natuurlyke Afbeeldingen en Beschryvingen der Cicaden en Wantzen*, door CASP. STOLL, Amsterdam. 1780. 4to.—And J. C. FABRICII, *Systema Rhynogotorum*. Braunsvigæ. 1803. 8vo.

(RÖSEL. Vol. II. *Heuschr.* Tab. 39.)

35. *CICADA*. Rostrum inflexum. Antennæ setaceæ. Alæ 4 membranacæ, deflexæ. Pedes plerisque saltatorii.

The males make a sound like the Grasshopper, which they produce by means of certain complicated organs placed on the abdomen. It is remarkable that some species of *Clavariæ* (parasitic fungi) grow in abundance on the Nymphæ of the Cicadæ, and also in the living body of their Larvæ; and in other Caterpillars, the Nymphæ of Butterflies and others*.

1. *Orni*. (Tettigonis O.—F.) *C. nigro-flava*, maculata, alis hyalinis, basi flavis maculis nigris.

(RÖSEL. Vol. II. *Heuschr.* Tab. 25. fig. 1, 2.)

In the South of Europe and North Africa, on some Species of Ash, whence they cause the exudation of manna by their punctures. Together with the *C. plebeia*. (RÖSEL. fig. 3.) is considered to be the Cicada of the ancients †.

2. *Spumaria*. (Cercopis S.—F.) The Froth-worm.—*C. fusca* elytris maculis binis albis lateralibus; fascia duplici interrupta albida.

(FRISCH. p. 8. Tab. 12.)

Particularly abundant upon Willow-trees, the sap of which the Larva sucks in Spring, and expels in the form of froth, within which it often lies hid. (*Cuckoo's spittle*, as it is called.)

3. *Lanata*. (Lystra L.—F.) *C. alis deflexis nigris; punctis cæruleis, fronte lateribusque rubris, ano lanato*.

(STOLL. Tab. 10. fig. 49. and D.)

In the West Indies.—Has its name from the long snow-white flocci attached to the posterior part of the body, but melting in water. It is probable that they may be the remains of parasitic plants which grew in the Larva or Nympha of the animal, as already mentioned.

36. *NOTONECTA*. Rostrum inflexum. Antennæ thorace breviores. Alæ 4 cruciato-complicatæ, antice coriaceæ. Pedes posteriores pilosi natatorii.

1. *Glauca*.—*N. grisea* elytris griseis margine fusco punctatis apice bifidis.

* FOUGEROUX in *Mem. de l'Acad. des Sc. de Paris*. 1769.—And THEOD. HOLMSKIOLD *beata ruris otia fungis Danicis impensa*. Havn. 1790. fol.

† But the true Grecian Cicada which one of my pupils, Dr. GLARAKES, sent me from Chios, and which differs from both the above, has, I find, been represented by PETIVER only, in *Gazophylac.* Tab. 15. fig. 7.

(FRISCH. p. 6. Tab. 13.)

It mostly swims on its back, and in this position catches the gnats, &c., on which it feeds, with great dexterity.

37. NEPA. Water-scorpion.—Rostrum inflexum. Alæ cruciato-complicatæ, antice coriaceæ. Pedes anteriores cheliformes; reliqui 4 ambulatorii.

1. *Cinerea*.—N. cinerea, thorace inæquali, corpore oblongo-ovato.

(FRISCH. p. 7. Tab. 15.)

The eggs of this animal are singularly shaped, with a hook at one end, like the seeds of the Corn-flower.

2. *Cimicoides*. (Naucoris C.—F.) N. abdominis margine serrato.

(FRISCH. p. 6. Tab. 14.)

3. *Plana*. (Nepa rustica. F.) N. subfusca; oculis nigris, alis albidis, dorso plano.

A certain Species of Water-mite lays its eggs on the back of this Insect, which is a native of Tranquebar*.

38. CIMEX. Bug. Ger. Wanze. Fr. Punaise.—Rostrum inflexum. Alæ 4 cruciato-complicatæ, superioribus antice coriaceis. Dorsum planum thorace marginato. Pedes cursorii.

1. *Lectularius*. (Acanthis lectularia. F.) The Bug.—C. flavescens, alis nullis.

(SULZER'S Kennz. Tab. 10. fig. 69.)

Little certain is known of the original habitation of this disgusting animal, which is now found in the houses of dirty or careless persons in every part of the world. Though easily introduced into a house, they may, by attention and the use of proper measures, be as easily expelled in the first instance, which, however, becomes more difficult if they have been allowed to establish themselves.

Among the means commonly recommended, are olive oil or aqua fortis; ox-gall and sulphate of iron, equal parts; or a decoction of the tops and bark of the larch; or Spanish pepper, assafoetida and sulphur, each two drachms, for fumigation; but above all, fumigation with oxymuriatic acid gas (chlorine.)

* STOLL. Wanzen 2. D. Tab. 7. fig. 6. A.—SWAMMERDAM has made the same remark of the grey Water Scorpion of Europe.—See his *Biblia Naturæ*. T. 1. p. 230. Tab. 3. fig. 4, 5.

The juice of lemons or vinegar, sprinkled on the bed-clothes, serves as a palliative.

2. *Corticalis*. (Aradus C.—F.) C. membranæus, abdominis margine imbricatim secto, corpore nigricante.

In woods on the trunks of trees : it is scarcely to be detected, on account of its deceptive bark-like colour and form.

3. *Baccarum*.—C. ovatus griseus, abdominis margine nigro maculato.

In gardens, particularly on currant bushes. It gives out an offensive smell, but only when touched ; this odour, as in many other Bugs, appearing to serve the purpose of defence.

4. *Personatus*. (Reduvius P.—F.) C. rostro arcuato, antennis apice capillaceis, corpore oblongo subvillosa fusco.

(FRISCH. p. 10. Tab. 20.)

It always keeps in corners ; and the Larva covers itself with dust.

39. APHIS. Plant-louse. Ger. Blattlaus. Fr. Puceron. Rostrum inflexum. Antennæ thorace longiores. Alæ 4 erectæ aut nullæ. Pedes ambulatorii. Abdomen postice sæpius bicornè.

Aphides are often found with and without wings in the same Species, nay in the same family, and that without any relation to difference of the sexes. The males are smaller than the females, and a much greater proportion of them are young : they do not appear sooner than in the last generation of every Summer ; and in most Species only at the end of it, and for a short time. They then impregnate the females, which soon after lay eggs, or rather shells, containing the young Aphides fully formed ; which, however, are not hatched until the succeeding Spring. All these newly hatched Aphides are females, and no male appears until the last generation of the Summer, as already stated. Notwithstanding this, all the females are capable of producing without copulation : so that it seems as though a single copulation in Autumn exerts a fecundating influence over many, even nine, successive generations of the following Spring and Summer.

1. *Ribis*. A. ribis rubri.

(FRISCH. p. 11. Tab. 14.)

2. *Ulmi*. A. ulmi campestris.

3. *Sambuci*. A. sambuci nigræ.

(FRISCH. p. 11. Tab. 18.)

4. *Rosæ*. *A. rosæ*.

(SULZER'S *Kennz.* Tab. 2. fig. 79.)

5. *Bursaria*. *A. populi nigræ*.

(SWAMMERDAM *Biblia Naturæ*. Tab. 45. fig. 22.)

On the black poplar, where it causes remarkable excrescences.

6. *Pistaciæ*.—*A. nigra*, alis albidis, tibiis longissimis, thorace verrucoso.

On the *Pistacia*, *Mastiche*, and *Turpentine* trees, where they envelope themselves in a pod-like cocoon, a span long.

40. *CHERMES*. Rostrum pectorale. Antennæ thorace longiores. Alæ 4 deflexa. Thorax gibbus, pedes saltatorii.

They resemble the winged *Aphides* in form. The *Larvæ* are very similar to the *Cicadæ*, and leap in the same manner.

1. *Buxi*. *C. buxi*.

2. *Alni*. *C. betulæ alni*.

(FRISCH. p. 8. Tab. 13.)

41. *Coccus*. Rostrum pectorale. Abdomen postice setosum. Alæ 2 erectæ masculis. Feminae apteræ.

In no other animals are the sexes so strikingly dissimilar. The male is like a little gnat; the female, on the contrary, is without wings, and after having changed her skin, sits nearly motionless, so that in some Species she might be taken for a cicatrix on the plant, rather than a living animal. The male flits about until such time as he seeks out and impregnates one of these sedentary females.

1. *Hesperidum*. *C. hybernaculorum*.

(SULZER'S *Kennz.* Tab. 12. fig. 81.)

The female is found chiefly on the under surface of the leaf of orange trees.

2. *Adonidum*. *C. rufa farinacea pilosa*.

As well as the former, in hot-houses, and particularly on the coffee-tree. It may be destroyed by sprinkling the plants with flowers of sulphur.

3. *Ilicis*. The *Kermes*.—*C. quercus cocciferæ*.

In the South of Europe, particularly Greece, Provence, on the Holly. Carmine is prepared by sprinkling vinegar on the berry or gall-shaped nests of this animal's eggs.

4. *Polonicus*. *C. radicis scleranthi perennis*.

(FRISCH. p. 5. Tab. 2.)

Makes similar nests for its eggs on the roots of various plants.

It is very abundant in Poland and on the Don, and is collected to be employed as a dye.

5. *Cacti*. The Cochineal Insect. *Ger.* der Sharlachwurm. *Fr.* la Cochenille.—*C. cacti coccinelliferi*.

(ELLIS. in *Phil. Trans.* Vol. LII. p. 2.)

Originally in Mexico: It is found on several Species of Cactus, planted for the purpose, on which the Cochineal-worms are reared like Silk-worms, and collected three times in the year.

6. *Lacca*. The Lac-Insect.—*C. ficus indicæ et religiosæ*.

(DR. ROXBURGH, in *Voigt's Magazine*, Vol. VIII. p. 4. Tab. 1.)

Chiefly in the hilly parts of Hindostan, on both sides of the Ganges. It produces the Gum-lac. A white wax-like kind of lac has been lately found near Madras, the specimens of which, in my possession, consist of single cells resembling coffee-berries in size and shape; it may prove very valuable in India, where bees-wax is scarce.

42. THRIPS. Rostrum obscurum. Antennæ longitudine thoracis. Abdomen sursum reflexile. Alæ 4 rectæ, dorso incumbentes, longitudinales, angustæ, subcruciatae.

Exceedingly small Insects, which keep together in the flowers of many plants, and are chiefly remarkable for their number and the agility with which they leap and fly.

1. *Physapus*.—*T. elytris glaucis, corpore atro*.

(DE GEER, in *Schwed. Abhandl.* 1744. Tab. 4. fig. 4.)

In corn, the flowers of beans and other plants.

III. LEPIDOPTERA. (Glossata. FABR*.)

Butterflies, an extensive Order, distinguished by having expanded wings, covered with coloured scales, and hairy bodies. As Caterpillars they have jaws, twelve eyes on the head, an

* On the history of this Order consult; E. J. C. ESPER's *Schmetterlinge*. Erlangen. 1776. gr. 4to.

J. HUBNER's *Schmetterlinge in Abbildungen*. Augsb. 4to. *Systematische Beschreibung der Europäischen Schmetterlinge*. 1 Th. Rostock. 1785. 8vo.

M. B. BORKHAUSEN's *N. G. der Europäischen Schmetterlinge*. Frkft. 1788. 8vo.

F. OCHSENHEIMER's *Schmetterlinge von Europa*. Dresd. seit. 1817. 8vo.

DENIS und SCHIFFERMULLER, *Systematisches Verzeichniss der Schmetterlinge der Wiener Gegend*. Wien. 1776. gr. 4to.—2te. verm. Ausg. von ILLIGER and HAFELI. Braunsch. 1800. 2. B. 8vo.

extended body in twelve segments, with nine spiracles on each side, three pair of hook-shaped claws on the thorax, and commonly five pair of round fleshy legs on the abdomen. The Caterpillar changes in different ways, becomes a Pupa, which is generally incapable of motion, some few inconsiderable Species excepted. After a certain time this Pupa or Chrysalis changes into the Butterfly, which has mostly long Antennæ; but three pair of feet; a spirally rolled tongue (as it is called,) in place of jaws; and instead of twelve small eyes, two large semicircular and three small ones. (§ 126.) LINNÆUS, has arranged all the very numerous Species in three Genera.

43. PAPILIO. Butterfly. *Ger.* Tagvogel. *Fr.* Papillon.—
Antennæ apicem versus crassiores, sæpius clavato-capitatae. Alæ erectæ sursumque conniventes.

The Caterpillar is generally beset with prickles, and undergoes four different changes of skin. It changes into a Pupa without making any external web; the Pupa is dentated, often of a beautiful gold colour, (chrysalis, aurelia,) and suspends itself by its posterior extremity. The Butterfly flies only in the day-time, and when sitting, elevates its four expanded wings, with the upper surfaces, which in many instances differ materially in their colour and marks from the under ones, turned toward each other.

For the sake of convenience LINNÆUS has subdivided the whole Genus into five families (*phalanges*.)

(a.) EQUITES. Alis primoribus ab angulo postico ad apicem longioribus, quam ad basin; his sæpe antennæ filiformes.

Tröes, ad pectus maculis sanguineis, (sæpius nigri.)

Achivi, pectore incruento, ocello ad angulum ani.

(b.) HELICONII. Alis angustis integerrimis, sæpe denudatis: primoribus oblongis, posticis brevissimis.

(c.) DANAI. Alis integerremis.

Candidi, alis albidis.

Festivi, alis variegatis.

CHR. SEPP, *Nederlandsche Insecten*. Amst. seit. 1762. 4to.

C. CLERCK, *Incones Insectorum Rariorum*. Holm. 1759. 2 Vols. 4to.

P. CRAMER, *Nithlandische Rappellen*. Amst. 1775. 4to.

The Natural History of the rarer Lepidopterous Insects of Georgia, collected from ABBOT'S Observations by J. E. SMITH. London, 1797. 2 Vols. folio.

JOH. MADER'S *Raupencalender*, Herausgegeben von C. F. C. KLEEMAN. Ed. 2. Nürnberg. 1785. 8vo.

(d.) NYMPHALES. Alis denticulatis.

Gemmati, alis ocellatis.

Phalerati, alis cæcis absque ocellis.

(e.) PLEBEII. Parvi. Larva sæpius contracta.

Rurales, alis maculis obscurioribus.

Urbicolæ, alis maculis pellucidis.

1. *Priamus*. P. E. T. alis denticulatis tomentosis supra viridibus, institis atris, posticis maculis sex nigris.

(CLERCK. Tab. 17.)

In Amboina. Is a large splendid animal, as is also the following:—

2. *Ulysses*. P. E. A. alis caudatis fuscis, disco cæruleo splendente dentato. Posticis subtus ocellis septem.

(CLERCK. Tab. 23. fig. 1.)

Also in the East Indies.

3. *Machaon*. P. E. A. alis caudatis concoloribus flavis, limbo fusco, lunulis flavis, angulo ani fulvo.

(RÖSEL. Vol. I. *Tagvögel*. 2. Tab. 1.)

4. *Podalirius*. P. E. A. alis caudatis subconcoloribus flavescenscentibus: fasciis nigricantibus geminatis: posticis subtus linea aurantia.

(RÖSEL. Vol. I. *Tagvögel*. 2. Tab. 2.)

5. *Apollo*. P. H. alis oblongis integerrimis albis: posticis ocellis supra 4: subtus 6, basique rubris.

(SULZER's *Kennz*. Tab. 13. fig. 41.)

In the warmer parts of Europe.

6. *Cratægi*. P. H. alis integerrimis rotundatis albis: venis nigris.

(RÖSEL. Vol. I. *Tagvögel*. 2. Tab. 3.)

The Caterpillar is one of the most injurious to fruit trees. The young ones keep together in a cocoon.

7. *Brassicæ*. P. D. C. alis integerrimis rotundatis albis; primoribus maculis duabus apicibusque nigris major.

(RÖSEL. Vol. I. *Tagvögel*. 2. Tab. 4.)

With the two following, on cabbages and turnips.

8. *Rapæ*. P. D. C. alis integerrimis rotundatis: primoribus maculis duabus apicibusque nigris, minor.

(RÖSEL. Vol. I. *Tagvögel*. 2. Tab. 45.)

9. *Napi*. P. D. C. alis integerrimis rotundatis albis subtus venis dilatato-virescentibus.

10. *Cardamines*. P. D. C. alis integerrimis rotundatis albis, primoribus medio fulvis, posticis subtus viridi-nebulosis.

(RöSEL. Vol. I. *Tagvögel*. 2. Tab. 8.)

11. *Rhamni*. P. D. C. alis integerrimis angulatis flavis : singulis puncto flavo, subtus ferrugineo.

(RöSEL. Vol. III. Tab. 46.)

12. *Hyperantus*. P. D. F. alis integerrimis fuscis, subtus primoribus ocellis tribus : posticis duobus tribusque.

13. *Io*. P. N. G. alis angulato-dentatis fulvis nigro-maculatis : singulis subtus ocello cæruleo.

(RöSEL. Vol. I. *Tagvögel*. 2. Tab. 3.)

The Pupa appears as though gilt.

14. *Galatea*. P. N. G. alis dentatis albis nigroque variis, subtus primoribus ocello unico, posticis quinque obsoletis.

(RöSEL. Vol. III. Tab. 37.)

15. *Cardui*. P. N. G. alis dentatis fulvis albo nigroque variegatis, posticis utrinque ocellis quatuor, sæpius cæcis.

(RöSEL. Vol. I. *Togvögel*. 1. Tab. 10.)

The Pupa glittering like gold. Very numerous in certain years.

16. *Iris*. P. N. G. alis subdentatis subtus griseis ; fascia utrinque alba interrupta, posticis supra uniocellatis.

(RöSEL. Vol. III. Tab. 42.)

17. *Antiopa*. P. N. P. alis angulatis nigris limbo albedo.

(RöSEL. Vol. I. *Tagvögel*. 1. Tab. 1.)

18. *Polychloros*. P. N. P. alis angulatis fulvis nigro maculatis ; primoribus supra punctis quatuor nigris.

(RöSEL. Vol. I. *Tagvögel*. 2. Tab. 2.)

The Caterpillar gives out a musky smell.

19. *Urtica*. P. N. P. alis angulatis fulvis nigro-maculatis : primoribus supra punctis tribus nigris.

(RöSEL. Vol. I. *Tagvögel*. 1. Tab. 4.)

20. *C. album*. P. N. P. alis angulatis fulvis nigro maculatis, posticis subtus C. albo notatis.

(RöSEL. Vol. I. *Tagvögel*. 1. Tab. 5.)

21. *Atalanta*. P. N. P. alis dentatis nigris albo maculatis : fascia communi purpurea, primoribus utrinque, posticis marginali.

(RöSEL. Vol. I. *Tagvögel*. 1. Tab. 6.)

One of the most beautiful Butterflies of Europe.

22. *Paphia*. P. N. P. alis dentatis luteis nigro-maculatis ; subtus lineis argenti transversis.

(RÖSEL. Vol. I. *Tagvögel*. 1. Tab. 7.)

A very beautiful animal of middling size.

23. *Aglais*. P. N. P. alis dentatis flavis nigro maculatis : subtus maculis 21 argenteis.

24. *Pruni*. P. P. R. alis subcaudatis supra fuscis ; posticis subtus fascia marginali fulva nigro-punctata.

(RÖSEL. Vol. I. *Tagvögel*. 2. Tab. 7.)

On plumb trees.

25. *Argus*. P. P. R. alis ecaudatis cæruleis : posticis subtus limbo ferrugineo : ocellis cæruleo-argenteis.

(RÖSEL. Vol. I. *Tagvögel*. 2. Tab. 37.)

26 *Malvæ*. P. P. U. alis denticulatis divaricatis nigris albo-maculatis.

(RÖSEL. Vol. I. *Tagvögel*. 2. Tab. 10.)

44. SPHINX. Hawk-moth. Ger. Abendvogel. Antennæ medio crassiores, sive utraque extremitate attenuatæ, sub-prismaticæ. Alæ deflexæ.

The Caterpillars in this Genus have mostly splendid colours and a hook-shaped horn at the end of the back, the remains of which are visible in the Pupa. The change into a Chrysalis takes place under ground and without a cocoon. These Moths mostly fly in the dusk of evening, and slowly and heavily. LINNÆUS has divided the whole Genus, which, however, is not very extensive, in the following manner :

(a.) LEGITIMÆ. Alis angulatis.

Alis integris, ano simplici.

Alis integris, ano barbato.

(b.) ADSCITÆ—habitu et larva diversæ.

1. *Ocellata*. S. L. alis repandis : posticis ocellatis.

(RÖSEL. Vol. I. *Nachtvögel*. 1. Tab. 1.)

2. *Nerii*. S. L. alis subangulatis viridibus : fasciis variis pallidioribus saturatioribus flavescensibusque.

(RÖSEL. Vol. III. Tab. 16.)

3. *Convolvuli*. S. L. alis integris : posticis nigro fasciatis margine postico albo-punctatis, abdomine rubro cingulis atris.

(RÖSEL. Vol. I. *Nachtvögel*. 1. Tab. 7.)

4. *Ligustri*. S. L. alis integris : posticis incarnatis fasciis nigris, abdomine rubro cingulis nigris.

5. *Atropos*. S. L. alis integris : posticis luteis fasciis fuscis, abdomine luteo cingulis nigris.

(RöSEL. Vol. III. Tab. 2.)

A most injurious animal for Bee-hives. The Caterpillar lives on the Jasmine, Potatoe, &c.

6. *Gelerio*. S. L. alis integris griseis lineola albo-nigra; inferioribus basi rubris muaculis sex.

(RöSEL. Vol. IV. Tab. 8.)

7. *Elpenor*. S. L. alis integris virescentibus, fasciis purpureis variis, posticis rubris basi atris.

(RöSEL. Vol. I. *Nachtvögel*. 1. Tab. 4.)

8. *Porcellus*. S. L. alis integris margine rubris; posticis basi fuscis.

(RöSEL. Vol. I. *Nachtvögel*. 1. Tab. 5.)

9. *Euphorbiæ*. S. L. alis integris fuscis, vitta superioribus pallida, inferioribus rubra.

(RöSEL. Vol. I. *Nachtvögel*. 1. Tab. 3.)

10. *Pinastri*. S. L. alis integris canis, margine postico albo maculato, abdomine fusco cingulis albis.

(RöSEL. Vol. I. *Nachtvögel*. 1. Tab. 6.)

In pine forests, where the Caterpillar, which lives on the summits of the trees, often commits great ravages.

11. *Stellatarum*. (*Sesia Stell.*—FAB.) S. L. abdomine barbato lateribus albo nigroque variis, alis posticis ferrugineis.

(RöSEL. Vol. I. *Nachtvögel*. 1. Tab. 8.)

12. *Filipendulæ*. (*Zygæna F.*—FAB.) S. A. alis superioribus cyaneis: punctis sex rubris: inferioribus rubris immaculatis.

(RöSEL. Vol. I. *Nachtvögel*. 2. Tab. 62.)

13. *Phegea*. (*Zygaena guercus*. F.) S. A. viridi-atra, alis punctis fenestratis: superiorum sex, inferiorum duobus, abdomine cingulo luteo.

45. *PHALÆNA*. Moth. *Ger. Nachtvogel*-Antennæ setacæ, a basi ad apicem sensim attenuatæ. Alæ sedentis sæpius deflexæ.

The most extensive Genus among Insects. The Caterpillars are mostly hairy. They generally change into Pupæ within a silky cocoon, which they prepare from a tenacious fluid contained in two pouches placed along the back, beneath the stomach. This fluid they spin into very fine threads, by means of a particular tube placed behind the mouth*. These con-

* LYONET *Traité Anatomique*. Tab. 2. fig. 8, 9, 10. p. 54.—Tab. 5. fig. 1. p. 111.—and Tab. 14. fig. 10, 11. p. 498.

structions are remarkable in some instances, for their very artificial formation, and in others, as the Silk-worms, for their great utility. LINNÆUS has subdivided the *Phalænæ* into the following families :—

(a.) *ATTACI*—*alis patulis inclinatis.*

Pectiniformes.

Seticornes.

(b.) *BOMBYCES*—*alis incumbentibus ; antennis pectinatis.*

Elingues, absque lingua manifeste spirali.

Spirilingues, lingua involuto-spirali.

(c.) *NOCTUÆ*—*alis incumbentibus. Antennis setaceis, nec pectinatis.*

Elingues.

Spirilingues.

(d.) *GEOMETRÆ*—*alis patentibus horizontalibus quiescentes.*

Pectinicornes.

Seticornes.

(e.) *TORTRICES*—*alis obtusissimis, ut fere retusis, margine exteriori curvo.*

(f.) *PYRALIDES*—*alis conniventibus in figuram deltoideam forficatam.*

(g.) *TINÆ*—*alis convolutis, fere in cylindrum, fronte prominula.*

(h.) *ALUCITÆ*—*alis digitatis fissis ad basin usque.*

-
1. *Atlas.* (*Bombyx A.—F.*) *P. Att. pectinicornis elinguis, alis falcatis concoloribus luteo-variis, macula fenestrata, superioribus sesquialtera,*

(*MERIANÆ Surinam. Tab. 32.*)

In both Indies. The wings are larger than those of a common Bat, but the body remarkably small. The wild Silk, as it is called, is obtained in China from the cocoons of this and other large *Phalænæ*.

2. *Pavonia.* (*Bombyx R.—F.*) *P. Att. pectinicornis elinguis, alis rotundatis griseo-nebulosis subfasciatis : ocello nictitante subfenestrato.*

(*RÖSEL. Vol. I. Nachtvögel. 2. Tab. 4, 5.*)

The cocoon has the shape of a round flask, with a neck apparently open ; but with the entrance defended internally in a very artificial manner by elastic converging prickles connected into a projecting point, so that the Insect, when full grown, can easily creep out, but no enemy enter at this way.

M. HEEGER, of *Bercholdsdorf*, near Vienna, has lately endeavoured to employ the cocoons of a smaller Species of this name, (*Ph. pavonia minor* or *Bombyx carpinii*) for the purpose of manufacture on a large scale.

3. *Quercifolia*. (*Bombyx Q.—F.*) P. B. elinguis, alis reversis semitectis dentatis ferrugineis margine postico nigris.

(RÖSEL. Vol. I. *Nachtvögel*. 2. Tab. 41.)

When sitting, this *Phalæna* has a remarkable hump-backed appearance.

4. *Pini*. (*Bombyx P.—F.*) P. B. elinguis, alis reversis griseis; strigis duabus cinereis; puncto albo triangulari.

(RÖSEL. Vol. I. *Nachtvögel*. 2. Tab. 59.)

The Caterpillar, one of the most injurious to pine forests.

5. *Vinula*. (*Bombyx V.—F.*) P. B. elinguis albida nigropunctata, alis subreversis fusco venosis striatisque.

(RÖSEL. Vol. I. *Nachtvögel*. 2. Tab. 19.)

The Caterpillar has a remarkable appearance on account of its short, thick head, and the two prickles at the tail which it possesses instead of the hindermost pair of feet. In case of necessity it can defend itself by ejecting an acrid fluid from an opening on the under part of the neck*.

6. *Fagi*. (*Bombyx F.—F.*) P. B. elinguis alis reversis rufo-cinereis; fasciis duabus linearibus luteis flexuosis,

(RÖSEL. Vol. III. Tab. 12.)

This Caterpillar is also very strangely shaped, with long front legs, two horny prickles on the tail, &c.

7. *Mori*. (*Bombyx M.—F.*) The Silkworm. P. B. elinguis, alis reversis pallidis; striis tribus obsoletis fuscis maculaque lunari.

(RÖSEL. Vol. III. Tab. 7, 8.—J. L'ADMIRAL. Tab. 9.)

The Assyrian *Bombyx* of PLINY was doubtless our Silk; but it was then only known in the manufactured state, the Worm having been first brought to Europe in the time of Justinian. It remains in the Caterpillar state six or seven weeks, during which period it changes its skin four times, and then surrounds itself with a cocoon of a white or yellow colour, which, when it weighs two grains and a half, consists of a thread 900 feet long, 180 of which, when placed close together, are only one line in thickness: lastly, at the end of three weeks it makes its escape from the cocoon as a Moth. After impregnation, the female is very bulky, and lays about 500 eggs, which are

* SEPP, *Nederl. Insecten*, 4. St. 5. Verhandl. S. 25. Tab. 5.

hatched in the following Spring, about the time that the white Mulberry comes into leaf. The Insect is originally a native of China, but thrives well in our climate, and also in North America. The Silk from which very delicate, light, and yet firm, fabrics are made in Japan, is procured from a distinct Species—*Phalæna* (noctua) *serici*. See THUNBERG in the *Swedish Transact.* 1781. Vol. II. Tab. 5. fig. 1, 2.

8. *Neustria*. (Bombyx N.—F.) P. B. elinguis, alis reversis : fascia sesquialtera ; subtus unica.

(RÖSEL. Vol. I. *Nachtvögel*. 2. Tab. 6.)

With the following, the Caterpillar is very injurious. The *Phalæna* lays its eggs in a spiral manner about the twigs of trees.

9. *Pityocampa*. (Bombyx P.—F.) P. B. elinguis, alis griseis : strigis tribus obscurioribus, posterioribus pallidis ; puncto anali fusco.

Does much mischief in pine forests.

10. *Caia*. (Bombyx C.—F.) P. B. elinguis, alis deflexis fuscis : rivulis albis, inferioribus purpureis nigro punctatis.

(RÖSEL. Vol. I. *Nachtvögel*. 2. Tab. 1.)

11. *Monacha*. (Bombyx M.—F.) P. B. elinguis, alis deflexis, superioribus albis atro-undatis, abdominis incisuris sanguineis.

(JORDEN'S *Geschichte der Kleinen Fichtenraupe*. fig. 17-19.)

Also a most formidable animal to pine forests.

12. *Dispar*. (Bombyx D.—F.) P. B. elinguis, alis deflexis : masculis griseo fuscoque nebulosis : femineis albidis lituris nigris.

(RÖSEL. Vol. I. *Nachtvögel*. 2. Tab. 3.)

Is named from the dissimilar form and size of the two sexes.

13. *Chrysorhæa*. (Bombyx Ch.—F.) P. B. elinguis, alis deflexis albidis, abdominis apice barbato luteo.

(RÖSEL. Vol. I. *Nachtvögel*. 2. Tab. 22.)

One of the most destructive Caterpillars to fruit trees. It is hatched in Autumn, and passes the Winter in society, among dry leaves, fastened by a web to twigs of trees, without suffering from the severest cold.

14. *Antiqua*. (Bombyx A.—F.) P. B. elinguis, alis planiusculis : superioribus ferrugineis lunula alba anguli postici.

(RÖSEL. Vol. I. *Nachtvögel*. 2. Tab. 39.)

The female without wings.

15. *Cæruleocephala*. (Bombyx C.—F.) P. B. elinguis cristata, alis deflexis griseis : stigmatibus albidis coadunatis.

(RÖSEL. Vol. I. *Nachtvogel*. 2. Tab. 16.)

Also injurious to fruit trees.

16. *Cossus*. (*Cossus ligniperda*. F.) P. B. elinguis, alis deflexis nebulosis, thorace postice fascia atra, antennis lamellatis.

(RÖSEL. Vol. I. *Nachtvögel*. 2. Tab. 18.)

The Caterpillar, the anatomy of which LYONET has so ably displayed. It lives on the elm, oak, &c., but principally on the willow, which it perforates in such a way, as to cause the trees to perish or fall with a moderate wind. The injury it produces is increased by its existing as a Caterpillar three years previous to changing into the Pupa state, a circumstance probably unexampled. It is so tenacious of life, that it will remain in an artificial vacuum for hours together without being injured, and under water for almost three weeks in the middle of Summer. It is remarkable also, that the Pupa has the power of locomotion, and when the time of its change approaches, can bore its way from the middle of the tree to the bark.

17. *Graminis*. (*Cossus Gr.*—FAB.) P. B. spirilinguis, alis depressis griseis : linea trifurca, punctoque albidis.

(Schwed. *Abhandl.* 1742. Tab. 2.)

18. *Æsculi*. (*Cossus Æ.* FAB.) P. N. elinguis lævis nivea, antennis thorace brevioribus, alis punctis numerosis cæruleo-nigris, thorace senis.

19. *Humuli*. (*Hepialus H.*—FAB.) P. N. elinguis fulva, antennis thorace brevioribus, maris alis niveis.

20. *Pacta*. (*Noctua P.*—F.) P. N. spirilinguis cristata, alis grisescentibus, inferioribus rubris, fasciis duabus nigris, abdomine supra rubro.

21. *Meticulosa*. (*Noctua M.*—F.) P. N. spirilinguis cristata, alis erosis pallidis : superioribus basi incarnata, intra triangulum fuscum.

On all kinds of garden-plants ; also on strawberries.

22. *Piniaria*. P. G. pectinicornis, alis fuscis flavo-maculatis subtus nebulosis : fasciis duabus fuscis.

Another Insect injurious to pine forests.

23. *Wavaria*. P. G. pectinicornis, alis cinereis : anticis fasciis 4 nigris abbreviatis inæqualibus.

(RÖSEL. Vol. I. *Nachtvögel*. 3. Tab. 4.)

Together with the following, on currant and gooseberry bushes.

24. *Grossulariata*. P. G. seticornis, alis albidis maculis rotundatis nigris : anticis strigis luteis.

(RÖSEL. Vol. I. *Nachtvögel*. 3. Tab. 2.)

25. *Brumata*.—P. G. seticornis, alis griseo-fuscis : striga nigra postice pallidioribus ; femina aptera.

(REAUMUR. T. 2. Tab. 30.)

One of the most noxious Insects to fruit-trees : the female is without wings, and lays her eggs in the flower buds.

26. *Viridana*. (Pyralis V.—F.) P. Ti. alis rhombeis, superioribus viridibus immaculatis.

(RÖSEL. Vol. I. *Nachtvögel*. 4. Tab. 3.)

27. *Farinalis*. (Pyralis F.—F.) P. P. palpis recurvatis, alis politis fuscescentibus : strigis repandis albidis area interjecta glauca.

(CLERCK. *Phal*. Tab. 2. fig. 14.)

In flour.

28. *Hercyniana*.—P. P. alis superioribus fuscis, fascia et maculis niveis subintearuptis ; posticis cinereis.

(J. v. USLAR *Pyralis Hercyniana*. figs. a. b. c.)

In pine forests, on the needle-like leaves.

29. *Pinetella*. (Crambus *pineti*.—F.) P. Ti. alis superioribus flavis, maculis duabus argenteis, anteriore oblonga, posteriore ovata.

(CLERCK. *Phal*. Tab. 4. fig. 15.)

Another Insect of pine-forests,

30. *Pellionella*. (Tinea P.—F.) P. Ti. alis canis, medio puncto nigro, capite subgriseo.

(RÖSEL. Vol. I. *Nachtvögel*. 4. Tab. 17.)

In furs, stuffed animals, &c.

31. *Sarcitella*. (Tinea S.—F.) P. Ti. alis cinereis, thorace utrinque puncto albo.

Principally in woollen cloths.

32. *Mellonella*. (Tinea M.—F.) P. Ti. alis canis postice purpurascentibus, striga alba, scutello nigro, apice candido.

(RÖSEL. Vol. III. Tab. 41.)

A most dangerous enemy to Bees.

33. *Granella*. (Alucita G.—F.) P. Ti. alis albo nigroque maculatis capite albo.

(ROSEL. Vol. I. *Nachtvögel*. 4. Tab. 11.)

In granaries, where it soon betrays itself by gnawing the grain, and stripping it of the husk.

34. *Gædartella*. (Tinea G.—F.) P. Ti. alis auratis : fasciis 2 argenteis : priore antrorsum, posteriore retrorsum arcuata.

(CLERCK. *Phal*. Tab. 12. fig. 14.)

35. *Lineella*. (Tinea L.—F.) P. Ti. alis fuscis, punctis tribus argenteis elevatis.

(CLERCK. *Phal.* Tab. 11, fig. 8.)

36. *Pentadactyla*. (Pterophorus *pentadactylus*.—F.) P. Al. alis patentibus fissis quinquepartitis niveis: digito quinto distincto.

It, as well as the other Moths of this Family, has an extraordinary appearance from the remarkable divisions of the wings.

IV. NEUROPTERA.

A small Order, the animals in which are distinguished by having four net-like or trelliced wings, which generally glitter with colours of every kind.—The Larvæ have six feet.

46. *LIBELLULA*. Dragon-fly. Ger. Wasserjungfer. Fr. Demoiselle.—Os maxillosum, maxillis pluribus. Antennæ thorace breviores. Alæ extensæ. Cauda maris hamoso-forcipata.

The Larvæ live in water, and have a very moveable mask or cap before the mouth, with which they seize their prey. The full-grown Insects copulate when flying, and in a very singular manner.

1. *Depressa*. L. alis omnibus basi nigricantibus, thorace lineis duabus flavis, abdomine lanceolato lateribus flavescente.

(RÖSEL. Vol. II. *Wasser-Ins.* 2. Tab. 6, 7. fig. 3.)

Occasionally appears in great crowds, as in Thuringia and the Harz, in the years 1806 and 1807*.

2. *Virgo*. (Agrion V.—F.) L. alis erectis coloratis.

(RÖSEL. Vol. II. *Wasser-Ins.* 2. Tab. 9.)

3. *Puella*. (Agrion P.—F.) L. alis erectis hyalinis.

(RÖSEL. Vol. II. *Wasser-Ins.* 2. Tab. 10, 11.)

47. *EPHEMERA*. Day-fly. Ger. Uferaas.—Os edentulum absque palpis. Ocelli 2 maximi supra oculos. Alæ erectæ, posticis minimis. Cauda setosa.

They live in water some years as Larvæ. After that time, in many places, millions of the perfectly formed Insects make their appearance from the water within a few days in the middle of Summer; they then also, contrary to what happens to other Insects, cast their skin again. In general, they live but a very short time in their perfect state, often only for a few hours.

* VOIGT's *Neues Magazin*. B. 12. S. 521.

1. *Vulgata*.—*E. cauda trisetata*, alis nebuloso-maculatis.

(SULZER'S *Kennz.* Tab. 17. fig. 103.—P. COLLINSON in *Phil. Trans.* No. 481. Tab. 2. fig. 2, 3, 4.)

The female lays an oval ball composed of numerous minute eggs.

2. *Horaria*. *E. cauda bisetata*, alis albis margine crassiore nigricantibus.

(SWAMMERDAM. *Bibl. Nat.* Tab. 13. fig. 13.)

48. *PHRYGANEÆ*. Caddice. Water-moth. *Ger.* Frühlingsfliege.—Os edentulum palpis 4. Ocelli 3. Antennæ thorace longiores. Alæ incumbentes, inferioribus plicatis.

The Larvæ live in water, and are remarkable for the very ingenious shell or hull, mostly cylindrical or quadrangular, which they construct and carry about with them like snails. Some compose these houses of portions of rushes, others of grass, sand, of little stones, of fresh-water shells, and so forth.

1. *Bicaudata*. (Semblis *B.*—*F.*) *P. cauda bisetata*, alis venosis reticulatis.

(SULZER'S *Kennz.* Tab. 17. fig. 6.)

2. *Striata*. *P. nigra*, alis testaceis, nervoso-striatis.

(FRISCH. p. 13. Tab. 3.)

3. *Rhombica*. *P. alis flavescentibus deflexo-compressis macula rhombea laterali alba.*

(RÖSEL. Vol. II. *Wasser-Ins.* 2. Tab. 16.)

49. *HEMEROBIUS*. dentibus 2 : palpis 4. Ocelli nulli. Alæ deflexæ (nec plicatæ) antennæ thorace convexo longiores, setaceæ porrectæ.

The Larva lives on shore. The perfect Insect resembles the last.

1. *Perla*. *H. luteo-viridis*, alis hyalinis : vasis viridibus.

(RÖSEL. Vol. III. Tab. 21. fig. 4, 5.)

It fastens its eggs in a very curious way to the leaves of trees, moss, &c. by means of a little upright, bristle-like point.

(REAUMUR. T. 3. Tab. 33.)

2. *Pulsatorius*. (*Psocus P.*—*F.*) *H. apterus*, ore rubro oculis luteis.

(SULZER'S *Gesch.* Tab. 29. fig. 3.)

In books, old paper, and also wood. It was formerly supposed to be always without wings. At any rate, individuals with wings are seen so seldom, that it is probable they possess them only for a very short time. (§ 136.)

50. MYRMELEON. Os maxillosum ; dentibus 2. Palpi 4 elongati. Ocelli nulli. Cauda maris forcipe e filamentis duobus rectiusculis. Antennæ clavatæ longitudine thoracis. Alæ deflexæ.

1. *Formicarius*. Ant-lion. Ger. der Ameisenlöwe. Fr. le Fourmilion.—M. alis macula alba marginali postica.

(RÖSEL. Vol. III. Tab. 17.)

The celebrated animal which, when in its larva state, digs a funnel-shaped pit in the sand and covers itself up to the neck, laying wait for and destroying the Ants and other small Insects, which not perceiving it, come to the edge of the pit, and slip in over the loose sand.

51. PANORPA. Rostrum corneum cylindricum. Palpi 2. Ocelli 3. Antennæ thorace longiores. Cauda maris chelata.

1. *Communis*. P. alis æqualibus nigro-maculatis.

(FRISCH. p. 9. Tab. 14. fig. 1.)

52. RAPHIDIA. Os dentibus 2 in capite depresso corneo. Palpi 4. Ocelli 3. Alæ deflexæ. Antennæ longitudine thorace antice elongati cylindrici. Cauda femina seta recurva laxa.

1. *Ophiopsis*. R. thorace cylindrico.

(RÖSEL. Vol. III. Tab. 21. fig. 6, 7.)

V. HYMENOPTERA. (Piezata. FAB.)

Insects with four membranous wings marked with strong but few vessels, and generally shorter and smaller than in the Insects of the foregoing Orders. In most, the females and those without sex are armed with a sting at the anus, and occasionally with venom, which they infuse into the puncture : hence the whole Order has by some Entomologists been called Aculeata. The Larvæ are of various forms, sometimes as Caterpillars with twenty feet, at others as Maggots without any *

53. CYNIPS. Os maxillis absque proboscide. Aculeus spiralis, sæpius reconditus.

The female lays her eggs in particular parts of certain plants, which consequently swell, and form remarkable excrescences,

* J. C. FABRICII, *Systema Piezatorum*. Brunsvigæ, 1804. 8vo.

J. JURINE, *Nouvelle Methode de Classer les Hymenoptères*. Genève. 1801. 4to.

serving for the abode of the Larva until such time as it has completed its changes, and is in a state to issue from its prison. It is also singular that each egg grows in size after it has been deposited in the plant, and sometimes doubles its size before the Larva makes its issue from it.

1. *Rosæ*. *C. nigra*, abdomine ferrugineo postice nigro, pedibus ferrugineis.

(FRISCH. p. 6. Tab. 1.)

On the wild rose, where it causes the mossy, woolly excrecences that were formerly officinal under the name of *Spongia cynosbati*.

2. *Quercus folii*. *C. nigra*, thorace lineato, pedibus griseis, femoribus subtus nigris.

(FRISCH. p. 2. Tab. 3. fig. 5.)

On oak leaves, where it causes the well known oak apples, which after they have been abandoned by the progeny of the original constructor, often become the residence of various kinds of small Wasps.

3. *Pscenes*. *C. ficus Caricæ*.

Particularly in the Islands of the Mediterranean, on the wild fig, which is therefore suspended over the cultivated one, that the Insect may pass to the latter, by which the size is increased and the ripening accelerated.

54. TENTHREDO. Os maxillis absque proboscide. Alæ planæ tumidæ. Aculeis laminis duabus serratis, vix prominentibus. Scutellum granis duobus impositis distantibus.

The Larva has the form of a Caterpillar, (thence called by REAUMUR *fausse chenille*,) and lives on the leaves principally of rose bushes and willows; but changes to a Chrysalis under ground.

1. *Lutea*. (*Cimbex*. *L.—F.*) T. antennis clavatis luteis, abdominis segmentis plerisque flavis.

(FRISCH. p. 4. Tab. 24.)

2. *Capreæ*. T. salicis.

(FRISCH. p. 6. Tab. 4.)

55. SIREX. Os maxillis 2 validis. Palpi 2 truncati: Antennæ filiformes, articulis ultra 24. Aculeus exsertus rigens serratus. Abdomen sessile mucronatum. Alæ lanceolatæ, planæ omnibus.

The female is very dexterous in perforating soft wood with her

saw-shaped sting, in order to lay her eggs there: the Larva remains in wood for some years*.

1. *Gigas*.—*S. abdomine ferrugineo: segmentis nigris, thorace villosa.*

(RÖSEL. Vol. II. *Humm. und Wesp.* Tab. 9.)

56. *ICHNEUMON*. Os maxillis absque lingua. Antennæ articulis ultra 30. Abdomen petiolatum plerisque.

Aculeus exsertus vagina cylindrica, bivalvi.

Very numerous animals, which contribute materially to the destruction of Caterpillars, Spiders, and other Insects. They lay their eggs in living Caterpillars, which, consequently, become diseased, and die either before or after their change into Pupæ. Many, also, are confined to other Species of their own Genus, in whose bodies they lay their eggs, so that, as ROLANDER has remarked of certain Species, some appear to be created solely for the destruction of others.

1. *Luteus* (*Ophion L.—F.*) *I. luteus thorace striato, abdomine falcato.*

2. *Glomeratus*. (*Cryptus G.—F.*) *I. niger, pedibus flavis.*

(REAUMUR. Vol. II. Tab. 33.)

Lays its eggs in the Caterpillar of the *Papilio brassicæ*, as the preceding one does in those of several *Phalænæ*.

3. *Globatus*. (*Cryptus Glob. F.*) *I. niger, pedibus ferrugineis.*

(FRISCH. p. 6. Tab. 10.)

On the stalks of grass. Remarkable for the very delicate cotton-like web, about the size of a pigeon's egg, within which, the numerous little Pupæ undergo their metamorphosis together.

57. *SPHEX*. Os maxillis absque lingua. Antennæ articulis 10. Alæ plano-incumbentes (nec plicatæ) in omni sexu. Aculeus punctorius reconditus.

The females of certain Species of this Genus dig a hole in sandy ground, drag a large Spider or the Caterpillar of a *Phalæna* into it, lame it by biting off its legs, and then lay an egg in each hole; so that the Larva may suck out the spinning-fluid of the animal which the mother has buried, and in that way prepare itself a habitation in which to pass through its metamorphosis.

1. *Sabulosa*.—*S. nigra hirta, abdomine fulvo, postice nigro petiolo longissimo.*

* FR. KLUG, *Monographia Siricum Germanicæ*. Berol. 1804. 4to.

(FRISCH. p. 2. Tab. 1. fig. 6, 7.)

2. *Cribraria*. (*Crabro cribrarius*. F.) S. nigra abdomine fasciis flavis, tibiis anticis clypeis concavis fenestratis.

(GOEZE *im Naturforscher*. St. 2. Tab. 2.)

The plates on the front feet of the male were long supposed to be perforated, whence the name of the animal; consequently this supposed sieve had a remarkable utility forthwith assigned to it, and a great deal was said on the wisdom of the construction of a part that never existed.

58. *CHRYISIS*. Golden-fly.—Os maxillis absque proboscide. Antennæ filiformes: articulo 1 longiore, reliquis 11 brevioribus. Abdomen subtus fornicatum, utrinque squama laterali. Anus dentatus aculeo subexserto. Alæ planæ. Corpus auratum.

1. *Ignita*.—C. glabra nitida, thorace viridi: abdomine aureo: apice quadridentato.

(FRISCH. p. 9. Tab. 10. fig. 1.)

59. *VESPA*. Wasp. *Ger.* Wespe. *Fr.* Guêpe. Os maxillis absque proboscide. Alæ superiores plicatæ in omni sexu. Aculeus punctorius reconditus. Oculi lunares. Corpus glabrum.

Most Species of this and the following Genus are remarkable for the social connexion in which thousands live together, and for the extremely ingenious nests and common habitations which they construct by their united efforts, with substances of various kinds, as Wasps with fibres of wood, Bees with wax, and so forth.

1. *Crabro*. The Hornet. *Ger.* die Hornisse. *Fr.* le Frelon. —V. thorace nigro antice rufo immaculato, abdominis incisuris puncto nigro duplici contiguo,

(FRISCH. p. 9. Tab. 11. fig. 1.)

2. *Vulgaris*. The Wasp.—V. thorace utrinque lineola interrupta, scutello quadrimaculato, abdominis incisuris punctis nigris distinctis.

(FRISCH. p. 9. Tab. 12. fig. 1.)

3. *Nidulans*.—V. nigra, thorace striga antica subscutelloque albis, abdominis segmentis margine flavis.

In Guiana. The external covering of its very ingenious nest, resembles fine pasteboard, covered with writing-paper.

60. *APIS*. Bee. *Ger.* Biene. *Fr.* Abeille.—Os maxillis atque proboscide, inflexa, vaginis duabus bivalvi-

bus. Alæ planæ in omni sexu. Aculeus feminis et neutris punctorius reconditus.

1. *Mellifica*. The Honey-Bee.—A. pubescens thorace subgriseo, abdomine fusco, tibiis posticis ciliatis, intus transverse stratis *.

It is known that among Bees, Wasps, Ants and Termites, the far greater number of individuals have no sex, that is, they are begotten by a male and brought forth by the impregnated female, without themselves possessing perfect sexual organs. In the present instance, the Queen, female or Mother-Bee, as she is called, is slender in the body, longer than the Drones, with short wings, a hairy head, dentelated jaws, brown feet, &c. The males or Drones are larger and thicker in the body, with long wings. The Working-Bees, those without sex, are smaller than either, moderately stout, the wings proportionally long, the jaws smooth, the legs black, and with a peculiar fossa on the hinder thighs for carrying various substances. These alone, of whom there may be 10,000 in a large hive, have the task of collecting materials, building the comb and attending the young ones. The younger part of them search flowers for the purpose of procuring wax and honey, which are received and separated in the hive by the elder ones. They feed the Larvæ with the pollen of flowers, keep the hive clean, and carry out the dead. They are armed with stings, which, however, are apt to remain in the wound, if pushed too far. The males, amounting to perhaps 700 in a large hive, have no other duty than that of copulating with the Queen, and that while flying. Many of them die immediately afterwards, and the rest die of hunger or are destroyed by the Working-Bees. The Queen-Bee thus so completely impregnated, lays her eggs in the cells, of which, those intended for the Drones are previously formed larger than the rest. When the progeny has arrived at maturity, about twenty days afterwards, they form a new colony or swarm. In the wild state, Bees build in hollow trees, under ground, and so forth. Man has contrived to domesticate them, and to promote their increase and utility by many ingenious inventions. Although single Bees have as

* For many other kinds of Honey-Bees, natives of Brazil, see W. PISO, *de Indiæ utriusque re Naturali*. p. 3. &c.—and J. STANES, in SAM. PURCHAS'S *Theatre of Political Flying Insects*. London, 4to. p. 203.

little heat as other cold-blooded animals, yet in the hive the temperature often reaches that of the human body *.

2. *Centuncularis*. (Anthophora C.—F.) A. nigra ventre lana fulva.

(FRISCH. p. 11. Tab. 2.)

Lives singly under ground, and makes a very ingenious habitation of the leaves of rose-bushes.

3. *Violacea*. (Xylocopa V.—F.) A. hirsuta atra, alis cærulescentibus.

(REAUMUR. Vol. VI. Tab. 6. fig. 1. 2.)

In old trees, in which it excavates its habitation longitudinally, and divides it into cells by thin layers of wood.

4. *Terrestris*. Bombus T.—F.) The Humble-Bee.—A. hirsuta nigra, thoracis cingulo flavo, ano albo.

(FRISCH. p. 9. Tab. 13. fig. 1.)

Builds its nest deep under ground.

5. *Muscarum*. (Bombus M.—F.) A. hirsuta fulva abdomine flavo.

(REAUMUR. Vol. VI. Tab. 2. fig. 3. 4.)

Covers its nest externally with moss.

6. *Cæmentaria*.—A. fulva abdomine nigro ; (femina nigro-violacea) pedibus fuscis.

Builds its nest with wonderful art and strength, of the sand and mortar of old walls exposed to the sun. The egg-shaped cells, of which there are about ten in every such nest, are lined with a fine web, and are, also, occasionally occupied by the *Attellabus apiarius* and others.

61. FORMICA †. Ant. Ger. Ameise. Fr. Fourmi.—Petiolus abdominis elongatus, nodulosus, aut munitus squamula erecta. Aculeus feminis et neutris reconditus. Alæ maribus et feminis, sed neutris nullæ.

* Of the numerous works on the history of Bees, I shall only quote six ; viz, SWAMMERDAM, *Bibl. Nat.* p. 369.

REAUMUR, *Mem.* Vol. V. p. 207.

J. HUNTER, in *Phil. Trans.* 1792. P. 1. p. 128.

HUBER, *Nouvelles Observations sur les Abeilles*. Genève. 1792. 8vo.

T. A. KNIGHT, in *Phil. Trans.* 1807. p. 234.—and in particular, as regards the increase of swarms by artificial means—BONNET, *Œuvres*. Vol. V. P. 1. p. 61.

† P. A. LATREILLE, *Essai sur l'Histoire des Fourmis de la France*. Brieve. 1798. 8vo.—and his *Histoire Naturelle des Fourmis*. Paris, 1802. 8vo.

P. HUBER, *Recherches sur les Mœurs des Fourmis Indigènes*. Paris, 1810. 8vo.

Most European Ants live particularly in woods and meadows, occasionally in societies of many thousands. The activity of this little race, and particularly the care with which they guard and attend their Pupæ, improperly called eggs, extends so far, that a working Ant has been known to drag ten Pupæ into a place of security, after the posterior part of its body was cut off.

1. *Herculanea*.—F. nigra, abdomine ovato, femoribus ferrugineis.

(SULZER'S *Kennz.* Tab. 19. fig. 125.)

2. *Rufa*.—F. thorace compresso toto ferrugineo, capite abdomineque nigris.
3. *Rubra*.—F. testacea, oculis punctoque suo abdomine nigris.
4. *Nigra*. (*Lasius niger*. F.) F. tota nigra nitida, tibiis cinerascens.

These Ants copulate about the end of Summer, when they occasionally appear in swarms of incalculable numbers and singular form, like columns ascending and descending, twenty of which may sometimes be seen together, and at a distance appear almost like an Aurora Borealis*.

5. *Cæspitum*.—F. abdominis petiolo binodoso : priore subtus, thoraceque supra bidentato.

(SULZER'S *Gesch.* Tab. 27. fig. 20.)

6. *Cephalotes*. (*Atta C.*—F.) F. thorace quadrispinoso, capite didymo magno utrinque postice mucronato.

(MERIANÆ *Ins. Surinam.* Tab. 18.)

In the West Indies. As large as a Wasp.

62. TERMES. White-ant. *Squamula intergerina nulla.*
Alæ maribus et feminis temporariæ; sed neutris plane nullæ.

1. *Fatalis*. (*bellicosus* SOLAND.) T. corpore fusco, alis fusciscentibus : costa ferruginea, stigmatibus subsuperis oculo propinquis, puncto centrali prominulo.

(*Abbild. Nat. Hist. Gegenst.* Tab. 9. and the nest of the *Termites* of Guinea. *Ibid.* Tab. 10.)

This Species is found in the East Indies and Guinea, besides four others, natives of various parts within the Tropics; particularly both Indies, the South-west of Africa, and New Holland. They construct conical habitations of clay, generally with several points, arched internally, often ten or twelve feet high,

* GLEDITSCH. *Mem. de l'Acad. des Sc. de Berlin.* 1749. plate 2.

and occasionally in such numbers, as at a distance to have the appearance of a village. In time, these Ant-hills become overgrown with grass, and so firm as to be capable of bearing the weight of several men, although the walls are perforated by large wide passages, sometimes more than a foot in diameter. Incessant changes are made in these buildings, old cells being broken up, new ones formed, others enlarged, and so on. The cells of the King and Queen, of which there is but one couple in each hill, are concealed in its remotest parts. Next to these, are the habitations of the workers; then follow the egg-cells for the young brood, and close to them the magazine. These animals gnaw and destroy furs, and furniture; sheds, and in a few weeks will, as it were, exterminate large trunks of trees. It has been already mentioned that the abdomen of the Queen is 2,000 times larger after, than before impregnation. She can then lay 80,000 eggs within twenty-four hours.

63. *MUTILLA*. Alæ nullæ in plerisque. Corpus pubescens. Thorax postice retusus. Aculeus reconditus punctorius.

1. *Occidentalis*. (M. *coccinea*. F.) M. *coccinea*, abdomine cingulo nigro.

In North America.

VI. DIPTERA *. (Antliata. FABR.)

Insects with two wings and two small knobs or balancers (halteres) placed on the thorax, behind the wings; and generally covered with a little scale; their use is yet unknown; from them some Naturalists have called this Order *Halterata*. The Larva is generally a Maggot †, the Pupa brown and cylindrical. The perfect Insect has, in some Genera, a hard pointed sucking-tube, in others a soft proboscis, and in others, a simple mouth. Some Species, also, are viviparous.

* J. C. FABRICII, *Systema Antliatorum*. Brunsvigæ. 1805. 8vo.

J. W. MEIGEN, *Systemat. Beschreib. der Europäisch. Zweyflügl. Insecten*. 2te Ausg.—Aachen. 1818. 8vo.

† The well known Mast-worm, (Heerwurm) a favourite food of wild Swine, consists in a singular collection of many thousand Maggots, scarcely half an inch long, of Insects of this Order, (probably *Tipula* or *Asilus*.) collected together. Such a collection is sometimes twenty-four feet long, as wide as a hand, and an inch thick, moving along in Summer, in the damp parts of woods, in the most regular manner.

64. *ÆSTRUS* *. *Gadfly*. *Ger.* Bremse. Os apertura simplex. Palpi duo, biarticulati apice orbiculares in depressione oris utrinque siti.

The females of the Species following, lay their eggs in the skin of living animals, causing, by that means, a kind of issue, serving for the subsistence of the Larva or Grub.

1. *Bovis*.—*O. alis immaculatis fuscis*, abdomine fascia atra media : apice pilis fulvo-flavis.

(*Abbild. Nat. Hist. Gegenst.* Tab. 47. fig. 1, 2.)

2. *Tarandi*. *O. alis immaculatis thorace flavo fascia nigra*, abdomine fulvo apice flavo.

3. *Equi*. (*Æstrus bovis*. LINN.) *O. alis albidis*, fascia media punctisque duobus nigris.

(*Abbild. Nat. Hist. Gegenst.* Tab. 47. fig. 3, 4, 5.)

Lays its eggs in the shoulders and fore-legs of the Horse, where the Larvæ when hatched can be licked off and swallowed. This, as well as the next Species is found generally, and in great numbers in the stomach of the Horse during Spring, to the internal membrane of which they are firmly attached by a hook at the anterior extremity of their bodies, (Botts,) which in size and shape resemble a Date.

4. *Hæmorrhoidalis*. *O. alis immaculatis fuscis*, abdomine atro, basi albo apiceque fulvo.

(CLARK. l. c. fig. 12, 13.)

Lays its eggs on the lips of the Horse.

5. *Ovis*.—*O. alis pellucidis*, basi punctatis, abdomine albo nigroque versicolore.

(*Abbild. Nat. Hist. Gegenst.* Tab. 27. fig. 6, 7.)

The Larva is found in the frontal sinuses of Deer, Goats, and particularly Sheep.

65. *TIPULA*. Crane-fly. *Ger.* Schnake. Os capitis elongati maxilla superiore fornicata : palpi duo incurvi capite longiores. Proboscis recurvata brevissima.

Very vivacious Insects, of which the Larva can live in water containing Sulphur, and which Prof. DE LUC met with at an elevation of 1560 toises above the Sea.

1. *Oleracea*. *T. alis patentibus hyalinis*, costa marginali fusca.

* The Natural History of this Genus, hitherto very imperfect, has been completely cleared up by Mr. BRACY CLARK, in his excellent *Observations on the Genus Æstrus*, contained in the *Transactions of the Linnean Society*. Vol. III. p. 289, &c.

(FRISCH. p. 4. Tab. 12.)

The Larva is very injurious to the roots of plants, particularly garden vegetables.

2. *Destructor*. The Hessian-fly *.—T. capite et thorace nigris, alis nigris basi fulvis.

(*Philadelphia Journal of Natural Sciences*. 1817. Tab. 3.)

A native of the United States of North America, where it does great injury to the Maize.

3. *Plumosa*. (*Chironomus plumosus*. F.) T. alis incumben-
tibus, thorace virescente, alis hyalinis puncto nigro.

(FRISCH. p. 11. Tab. 3-12.)

The blood-red Larva lives in water, and is the food of the Arm-Polype.

4. *Phalænoides*. (*Psychoda Ph.*—F.) T. alis deflexis cinereis ovato-lanceolatis ciliatis.

(FRISCH. p. 11. Tab. 3-11.)

A small animal which lives in damp places, privies, &c.

66. *MUSCA*. FLY. *Ger.* Fliege. *Fr.* Mouche.—Os proboscide carnosa : labiis 2 lateralibus : palpi duo.

1. *Vomitória*.—M. antennis plumatis, pilosa, thorace nigro, abdomine cæruleo nitente.
2. *Carnaria*.—M. antennis plumatis, pilosa nigra, thorace lineis pallidioribus, abdomine nitidulo tessellato : oculis rubris.

(FRISCH. p. 7. Tab. 14.)

Brings forth living Maggots.

3. *Domestica*.—M. antennis plumatis, pilosa nigra, thorace lineis 5 obsoletis, abdomine nitidulo tessellato, oculis fuscis.

(V. GLEICHEN. *Gesch. der gemeinen Stubenfliege*. Nürnberg. 1784. 8vo.)

Found in almost every part of the World, and in some places, as Otaheite, New Holland, the Cape, &c. in vast and troublesome numbers. The female when impregnated lays eighty eggs or more in stables, dunghills. In order to burst its Pupa shell, the fly can swell its forehead into a large bladder.

4. *Cellaris* (vinulus, conops.) M. antennis setariis, pilosa nigra, alis nervosis, oculis ferrugineis.

(REAUMUR. Vol. V. Tab. 8. fig. 7.)

A very small animal found in wine-cellars, and on sweet fruits, in a state of putrefaction.

* As it is commonly, but improperly, called, in North America.

5. *Meteorica*. M. antennis setariis, pilosa nigra, abdomine subcinereo, alis basi subflavis, oculis brunneis.
In gardens and woods. It has a peculiar jerking mode of flight.

6. *Putris*. (Tephritis P.—F.) M. antennis setariis, subpilosa atra, alarum costa nigra, oculis ferrugineis.

(FRISCH. p. 1. Tab. 7.)

The Maggot lives in rotten cheese.

67. *TABANUS*. Os proboscide carnosae, terminatae labiis duobus. Rostro palpis duobus, subulatis, proboscidi lateralibus, parallelis.

1. *Bovinus*. T. oculis virescentibus, abdominis dorso maculis albis trigonis longitudinalibus.

(REAUMUR. Vol. IV. Tab. 17. fig. 8.)

68. *CULEX*. Os aculeis setaceis intra vaginam flexilem.

1. *Pipiens*. The Gnat. *Ger.* die Mücke. *Fr.* le Cousin.—C. cinereus, abdomine annulis fuscis 8.

(KLEEMANN'S *Beytr. zu RÖSEL*. T. s. Tab. 15, 16.)

This troublesome little animal generally keeps in the vicinity of water. In many warm climates, (where the stings of all Insects cause violent inflammation, as happens with us in warm weather,) these creatures, which seamen, after the Portuguese, call Mosquitos, from their vast numbers, form a real plague. Ignorant travellers, however, apply the common term Mosquito to all Insects having stings, and resembling Gnats.

2. *Reptans*. (Scatopse R.—F.) C. niger, alis hyalinis, pedibus nigris annulo albo.

(NIEMANN'S *Taschenbuch. für Haushierärzte*. 2. Tab. 1. fig. 1.)

In the mountainous parts of Lapland, the South of Siberia, and particularly in Bannat, where it appears in innumerable flights in Spring and Summer, and creeps into all the openings of the bodies of horses and oxen, so as often to kill them in a few minutes. At the same time they are, if not dangerous, at least inconvenient, to men.

69. *EMPIS*. Os rostro corneo, inflexo, bivalvi, thorace longiore, valvulis horizontalibus.

1. *Pennipes*. E. antennis filatis, nigra, pedibus posticis longis: alterius sexus pennatis.

(SULZER'S *Kennz.* Tab. 21. fig. 137.)

70. *CONOPS*. Os rostro porrecto geniculato.

1. *Calcitrans*. (Stomoxys C.—F.) C. antennis subplumatis, cinerea glabra ovata.

(SULZER'S Kennz. Tab. 21. fig. 138)

Has almost the form of the common House-fly, except that it has a perforating snout instead of a proboscis. It enters houses only previous to rain, flies low, and settles on the legs, in the same manner that in the fields it fixes on the legs of cattle, making them uneasy, and causing them to stamp the ground.

71. *ASILUS*. Hornet-fly. Ger. Raubfliege.—Os rostro corneo porrecto, recto bivalvi.

1. *Crabroniformis*. A. abdomine tomentoso, antice segmentis tribus nigris, postice flavo inflexo.

(FRISCH, p. 3. Tab. 8.)

72. *BOMBYLIUS*. Buzz-fly. Ger. Schwebfliege. Fr. Bourdon.—Os rostro porrecto, setaceo, longissimo, bivalvi, valvulis horizontalibus, intra quas aculei setacei.

1. *Major*. B. alis dimidiato-nigris.

(SULZER'S Kennz. Tab. 28. fig. 22.)

73. *HIPPOBOSCA*. Os rostro bivalvi, cylindrico, obtuso, nutante. Pedes unguibus pluribus.

1. *Equina*. The Horse-louse. Ger. die Pferdelaus.—H. alis obtusis, thorace albo variegato, pedibus tetradactylis.

The impregnated mother is monstrously large, and lays only a single egg or rather Pupa, in which nothing is seen in the first weeks but a white fluid, which is gradually changed into the winged, full formed Insect.

2. *Ovina*. The Sheep-tick.—H. alis nullis.

(FRISCH, p. 5. Tab. 18.)

An Insect without wings, which, however, claims this situation from its general conformation.

VII. APTERA.

Insects without wings. They differ very much in regard to their size, form, mode of life, organs of mastication, number and length of feet, eyes, and so forth. They are partly oviparous, partly viviparous. The Flea excepted, they do not undergo metamorphoses properly so called.

74. *LEPISMA*. Pedes 6 cursorii. Os palpis 2 setaceis, et 2 capitatis. Cauda setosa setis extensis. Corpus squamis imbricatum.

1. *Saccharina*. (forbicina.) The Sugar-mite. *Ger.* der Zucker-gast.—*L.* squamosa, cauda triplici.

Originally a native of America, but now found in nearly every part of Europe.

75. *PRODURA*. Spring-tail.—*Pedes* 6 cursorii. *Oculi* 2 compositi ex octonis. *Cauda* bifurca, saltatrix, inflexa. *Antennæ* setaceæ elongatæ.

Many Species of this Genus (for instance, *P. nivalis*.) are occasionally found in vast numbers on newly fallen snow ; and that they cannot in all cases have crept from the ground through the snow, is proved by their having been found after high winds, on the fresh snow covering the ice of frozen seas. See *DE GEER*. in *Hist. de l'Ac. des Sc. de Paris*, 1750, p. 40.

1. *Fimetaria*.—*P. terrestris alba*.

Often in crowds under flower-pots.

76. *PEDICULUS*. Louse. *Ger.* Laus. *Fr.* Pou.—*Pedes* 6 ambulatorii, *oculi* 2. *Os* aculeo exserendo. *Antennæ* longitudine thoracis. *Abdomen* depressum sublobatum.

Probably one of the most extensively diffused Genera of animals. Most Mammifera and Birds have Lice of peculiar kinds ; and Fishes, together with even some Insects, are also plagued in the same way*.

1. *Humanus*. The Louse.—*P. Humanus*.

Besides man, it is, to my knowledge, found on the Chimpansee (*Simia troglodytes*.) and Coaita (*Cercopithecus paniscus*.) The lice of Negroes are black ; but that, as Oviedo relates, they disappear on crossing the Line, is a mere fable†.

2. *Pubis*. (Morphio.) The Crab-Louse.—*P. pubis*.

(*REDI*. l. c. Tab. 10. fig. 1.)

77. *PULEX*. Flea. *Ger.* Floh. *Fr.* Puce.—*Pedes* 6 saltatorii : *oculi* 2. *Antennæ* filiformes. *Os* rostro inflexo, setaceo aculeum recondente. *Abdomen* compressum.

1. *Irritans*, *P. proboscide corpore brevior*.

(*RÖSEL*. Vol. II. *Mücken*. Tab. 2, 3, 4.)

Besides man, it is found on the Dog, Fox, Cat, Hare, Squirrel, Hedgehog, &c. It is not met with in the extreme North of

* *F. REDI*, *Experimenta circa generationem Insectorum*. Opuscul. Ed. Amst. 1686. 12mo. p. 1. Tab. 1-24.

† The curious reader may consult Don Quixote, Part 2. Book 2. Chap. 12.—TRANSLATOR.

America, and but rarely in certain West India Islands, Martinique for instance. It may live at least six years.

2. *Penetrans*. P. proboscide corporis longitudine.

(CATESBY. *Nat. Hist. of Carolina*. 3. Tab. 10. fig. 3.)

Very troublesome in America, and resembling the common Flea in form and manner of leaping, but is much smaller. It keeps itself in the dust of the ground, and penetrates the skin of the toes in man, when the abdomen of the pregnant female swells to the size of a pea, causing violent inflammation, sometimes ending in gangrene.

78. *ACARUS*. Tick. *Ger. Milbe. Fr. Tique*.—Pedes 8.

Oculi 2 ad latera capitis. Tentacula 2 articulata, pediformia.

An extensive Genus, composed of numerous Species*, which in part, like Lice, infest other animals.

1. *Ricinus*. (*Ixodes R.—F.*) A. globoso-ovatus : macula basos rotunda ; antennis elevatis.

(FRISCH. p. 5. Tab. 19.)

2. *Telarius*. A. rubicundo-hyalinus, abdomine utrinque macula fusca.

(HERMANN. Tab. 2. fig. 15.)

Amongst others upon the Lime-tree. One of the most noxious vermin of Green-houses.

3. *Siro*. The Mite.—A. lateribus sublobatis, pedibus 4 posticis longissimis, femoribus capiteque ferrugineis, abdomine setoso.

In flour, cheese, ham, &c. It is born with only three pair of legs, the fourth appearing afterwards †.

79. *HYDRACHNA*. Pedes 8. Palpi 2 articulati. Oculi 2, 4, 6. Caput, thorax abdomenque unita.

1. *Despiciens*. (*Trombidium aquaticum*.—F. *Acarus aquaticus*. LINN.) H. rubra rotundata maculis pluribus ; oculis inferis.

(FRISCH. p. 8. Tab. 3.)

Almost like a small, blood-red Spider.

80. *PHALANGIUM*. Pedes 8. Oculi verticis 2 contigui. Frons antennis pediformibus. Abdomen rotundatum.

* J. F. HERMANN *Mémoire, aptérologique publié par F. L. HAMMER*. Strasb., 1804, folio, with coloured plates.

† For the opinions entertained on the *Acari Scabiei* (Itch-Insects), see KIRBY and SPENCE. Vol. I. p. 92.

1. *Opilio*. The Shepherd. *Ger.* der Weberknecht. *Fr.* le Fau-
cheur.—P. abdomine ovato ; subtus albo.

(SULZER'S *Kennz.* Tab. 22. fig. 140.)

A nocturnal animal, and one of the few land Insects that drink water. The legs have a vital motion after they have been a day torn from the body. The second pair of them appear to answer the purposes of antennæ. The eyes are placed between the shoulders.

2. *Cancroides*. (*Scorpio C.—F.*) P. abdomine obovato de-
presso, chelis lævibus, digitis pilosis.

(RÖSEL. Vol. III. Tab. 64.)

In old paper, &c. It has a remarkable appearance on account of its compressed body and long nippers. It walks like a crab.

3. *Balanarum*. P. abdomine dilatato muricato, rostro subu-
lato.

(PENNANT'S *British Zoology*. p. 4. Tab. 18. fig. 7.)

4. *Araneoides*. (*Solpuga A.—F.*) P. chelis dentatis villosis,
corpore oblongo.

(PALLAS. *Spicileg.* 9. Tab. 3. fig. 7, 9.)

In different parts of the hot climates of the Old World. Its bite causes violent inflammation, occasionally attended by dangerous symptoms.

81. ARANEA. Spider. *Ger.* Spinne. *Fr.* Araignée.—Pedes
8. Oculi 8. (plerisque.) Os unguibus sive retinaculis
papillis textoriis.

A remarkable Genus, containing numerous Species*, which all, as far as I am acquainted, feed on living animals, particularly Insects, and even attack each other. Most of them weave webs, of which the regular structure and the strength with which they resist the action of wind and weather, are equally deserving of notice†. The attempt has even been made, and has succeeded on a small scale, to manufacture a kind of silk from the webs of certain Species of Spider.—The Gossamer, (*Ger.* *fliegende Sommer, Mariengarn.*—*Fr.* *Filets de St. Martin, cheveux de la bonne Vierge*)—is, at least in great part, the work of a small species of Spider, (*A. obtectrix*.) which makes its webs in abundance during Spring on hedges and bushes.

* On the European Species of this Genus, see T. MARTYN'S *Natural History of Spiders*. Lond., 1793. 4to. including the works of ALBIN and CLERCK.

† See the Observations of Dr. REIMARUS in the Introduction to the 4th Edition of his Father's classical work on the Instinct of Animals. p. 8, &c.

1. *Diadema*. A. abdomine subgloboso rubro-fusco : cruce alba punctata.

(RÖSEL. Vol. IV. Tab. 35, 40.)

This and the following are the Spiders pointed out by QUATRE-MERE D'ISJONVAL, as certain indicators of weather.

2. *Domestica*. A. abdomine ovato fusco : maculis nigris 5 subcontiguus : anterioribus majoribus.

(MARTYN. Tab. 2. fig. 10.)

3. *Scenica*. A. saliens nigra : lineis semi-circularibus 3 albis transversis.

(MARTYN. Tab. 6. fig. 1.)

On roofs, &c. It leaps, and does not make a web.

4. *Saccata*. A. abdomine ovato ferrugineo fusco.

(FRISCH. p. 8. Tab. 3.)

It carries its eggs about in a bag attached to the posterior part of its body, and risks its life with great boldness to recover it when torn away*.

5. *Avicularia*. A. thorace orbiculato convexo : centro transverso excavato.

(KLEEMAN'S *Beytr. zu RÖSEL*. T. 1. Tab. 11. 12.)

In the West Indies : of the size of a small child's fist. The soles of the feet glitter with gold and other colours. It kills Humming-birds and sucks their eggs. Its bite also causes dangerous inflammation in man.

6. *Spithamea*. A. abdomine oblongo, pedibus longissimis.

(SEBA. *Thesaur*. Vol. IV. Tab. 90. fig. 9.)

In the East Indies. When the legs are extended it covers the space of a hand.

7. *Tarantula*. A. fusca, subtus atra, pedibus subtus atro fasciatis.

(*Abbild. Nat. Hist. Gegenst.* Tab. 38.)

In Apulia. The fable of its supposed inevitable consequences, and of the cure by music, may be explained, by supposing that travellers of easy faith have been deceived partly by the representations of hypochondriacal and hysterical patients, but more commonly by the artifices of beggars. This much is certain, that this Spider, which lives in little holes and fields, may inconvenience the reapers by its bite during harvest ; and that like that of many other Insects, its bite may, in the heat of Summer, become dangerous and even cause a kind of Chorea. (St. Vitus' Dance.)

* BONNET, *Œuvres*. Vol. I. p. 545.

8. *Edulis*. A. supra grisea; abdomine oblongo lateribus striatis; pedibus fulvis apicibus nigricantibus.

(LABILLARDIERE, *Voyage*. Tab. 12. fig. 4, 6.)

In New Caledonia, where the natives roast it and eat it by hundreds.

83. SCORPIO. Pedes 8, insuper chelæ 2 frontales. Oculi 2 in tergo. Palpi 2 cheliformes. Cauda elongata articulata, terminata mucrone arcuato. *Pectines* 2 subtus pectus et abdomen.

Scorpions have a considerable resemblance to Crabs in their form and mode of life, and like them they cast their shell yearly. They feed on other Insects and are viviparous. The sting of the small European one is not even dangerous, when uncomplicated with other circumstances, as extreme heat and so forth.

1. *Afer*. S. pectinibus 13-dentatis, manibus subcordatis pilosis.

(RÜSEL. Vol. III. Tab. 65.)

2. *Europæus*. S. pectinibus 18-dentatis, manibus angulatis.

(RÜSEL. Vol. III. Tab. 66. fig. 1, 2.)

83. CANCER. Crab. *Ger.* Krebs. *Fr.* Ecrevisse.—Pedes 8, insuper manus 2 chelatae. Oculi 2 distantes, plerisque pedunculati, elongati mobiles. Palpi 2 cheliferi. Cauda articulata inermis.

An extensive Genus, the Species of which LINNÆUS has divided into three families, according to the length and coverings of the tail*.

(A.) BRACHYURI.

1. *Pinnotheres*. C. brachyurus glaberrimus, thorace lævi lateribus antice planato, caudæ medio moduloso-carinato. The story that this Crab warns the Silk-muscle of the approach of the Sepia is unfounded: it may be attached to its fibrous beard like other Crabs, but without any object.

2. *Ruricola*. The Land-crab.—C. brachyurus, thorace lævi integerrimo, antice retuso: pedum articulis ultimis penultimisque undique spinosis.

(CATESBY. Vol. II. Tab. 32.)

In the West Indies and neighbouring parts of the world. It

* J. F. W. HERBST, *Versuch über die Natur Geschichte der Krabben und Krebse*. Zürich. 1782. 4to.

lives in holes under bushes ; but in Spring migrates, often in great numbers to the sea-shore to lay its eggs.

3. *Vocans*. The Sand-crab.—*C. brachyurus*, thorace quadrato inermi, chela altera ingenti.

(CATESBY. Vol. II. Tab. 35.)

In the East Indies and North America. The male is remarkable for the inequality of its nippers, of which one is not much larger than one of the animal's legs, whilst the other, on the contrary, is so heavy that when about to move, the animal is obliged to place it on his back.

4. *Mænas*. *C. brachyurus*, thorace læviusculo, utrinque quinque dentato, carpis unidentatis, pedibus ciliatis : posticis subulatis.

5. *Dromia*. *C. brachyurus hirsutus*, thorace utrinque dentato, pedibus posticis unguibus geminis.

(Abbild. Nat. Hist. Gegenst. Tab. 98.)

In the Indian Ocean. Like many other Species of Crabs, it has four legs on its back ; by means of which, it can seize empty shells, and in that way keep small fish or crabs for food.

6. *Pagurus*. The Pungur.—*C. brachyurus*, thorace utrinque obtuse novem-plicato, manibus apice atris.

(B.) PARASITICI, cauda aphylla.

7. *Bernhardus*. (*Pagurus B.*—*F.*) *C. macrourus parasiticus*, chelis cordatis muricatis : dextra majore.

(SULZER'S *Gesch.* Tab. 31. fig. 5.)

It inhabits the empty shells of other animals, and apparently without any selection of particular Genera or Species. Such shells are often inhabited by a Crab of this kind, and have attached to them externally *Alcyonia* and various Corals.

(C.) MACROURI.

8. *Canimarus*. (*Astacus marinus*. *F.*) The Lobster. *Ger.* der Hummer. *Fr.* l'Homard.—*C. macrourus* thorace lævi, rostro lateribus dentato : basi supra dente duplici.

In the Seas of the Northern World, where it, like many fishes, changes its situation at particular seasons.

9. *Astacus*. (*Astacus fluviatilis*.—*F.*) The Craw-fish. *Ger.* der Flusskrebs. *Fr.* l'Écrevisse de Rivière.—*C. macrourus* thorace lævi, rostro lateribus dentato : basi utrinque dente unico.

(RÖSEL. Vol. III. Tab. 54. 16.)

This animal, of which some varieties are naturally red, whilst

others remain black even when boiled, reaches the age of twenty years, and changes its shell yearly, at which time its three teeth and even its stomach are renewed. The two calcareous concretions found in Summer at both sides of its stomach, and commonly called Crab's-Eyes, are the principal materials from which the new shell is hardened. The accidental loss of legs, claws, &c. is easily repaired in this and other Species of Crabs, by their great power of reproduction. They even of themselves cast off their claws and legs, if they are bruised, or touched with a hot iron. The Lobster occasionally does the same thing after heavy thunder.

10. *Squilla*. (Palæmon S.—F.) The Shrimp. *Ger.* die Granate. *Fr.* la Chevrette.—*C. macrourus*, thorace lævi, rostro supra serrato, subtus tridentato, manuum digitis æqualibus.

(*Mem. de l'Ac. des Sc. de Paris*, 1772. p. 2. Tab. 1. fig. 1, 2.)

11. *Crangon*. (*Crangon vulgaris*.—F.)* *C. macrourus*, thorace lævi rostro integerrimo, manuum pollice longiore.

(RÖSEL. Vol. III. Tab. 63. fig. 1, 2.)

As well as the preceding very common on the coasts of Europe, particularly in the North Sea.

12. *Arctus*. (*Scyllarus A.*—F.) *C. macrourus*, thorace anteriorum aculeato, fronte diphylla, manibus subadactylis.

(GESNER. *Hist. aquatil.* p. 1097.)

13. *Mantis*. (*Squilla M.*—F.) *C. macrourus* articularis, manibus adactylis compressis falcatis serrato-dentatis.

(SULZER'S *Gesch.* Tab. 32. fig. 2.)

In the Mediterranean, and other Seas of the warmer parts of the World.

14. *Pulex*. (*Gammarus P.*—F.) *C. macrourus* articularis, manibus 4 adactylis, pedibus 10.

(RÖSEL. Vol. III. Tab. 62.)

Very common among water-cresses. It sometimes swims on its back.

15. *Stagnalis*. (*Gammarus St.*—F.) *C. macrourus* articularis, manibus adactylis, pedibus patentibus, cauda cylindrica bifida.

(SCHAFER'S *fischförmiger Kiesenfuss*. 1754. 4to.)

In stagnant waters.

84. MONOCULUS. Pedes natatorii. Corpus crusta tectum. Oculi approximati, testæ innati.

All the Species of this Genus as yet known, are found in water only*.

1. *Polyphemus*. (*Limulus P.—F.*) The Horse-shoe Fish.—
M. testa plana convexa sutura lunata, postica dentata,
cauda subulata longissima.

The largest of all Insects, reaching the length of four feet. That it should have been called one-eyed is ridiculous, having upwards of 2000. It is found not only in the East Indies, but also on the North-eastern coasts of America, and particularly in the Strait of Bahama.

2. *Apus*. (*Linnulus lacustris*. MULL.) M. testa subcompressa,
antice retusa, postice truncata, cauda biseta.

(SCHAFFER's *Krebsartiger Kiesenfuss*. Tab. 1.)

Only in a few parts of Germany; but there in wet years after floods, in astonishing numbers. As it appears, a true Hermaphrodite†, and in which SCHAFFER reckoned more than two million joints.

3. *Pulex*. (*Daphnia pennata*. MULL.) M. antennis dichotomis, cauda inflexa.

(SULZER's *Gesch.* Tab. 30. fig. 10.)

In rivers, ditches, and springs; and in some places so numerous, that it may have given rise to the sayings of water changed into blood.

4. *Conchaceus*. (*Cypris pubera* MULL.) M. testa bivalvi ovali tomentosa.

(MULLER. Tab. 5. fig. 1, 5.)

Also in fresh-water. In this and some similar Species, the little animal is attached to its shell like a Muscle.

85. ONISCUS. Pedes 14. Antennæ setaceæ. Corpus ovale.

1. *Ceti*. (*Cymothoa C.—F.*) O. ovalis, segmentis distinctis,
pedibus tertii quartique paris linearibus ovaticis.

(PALLAS. *Spicileg. Zoolog.* 9. Tab. 4. fig. 14.)

A tormentor of the Whale, attaching itself firmly to the fins, and organs of generation.

2. *Asellus*. (*Millepeda*.) the Wood-louse. *Ger. der Kellersesel.*
Fr. la Cloporte.—O. ovalis, cauda obtusa, stylis simplicibus.

86. SCOLOPENDRA. Pedes numerosi, totidem utrinque

* O. F. MULLER, *entomostraca s. insecta testacea*. Havn., 1785. 4to.

† Stralsund Magazine. Vol. I. p. 239.

quot corporis segmenta. Antennæ setaceæ. Palpi
2 articulati. Corpus depressum.

1. *Morsitans*. S. pedibus utrinque 20.

(SULZER's *Gesch.* Tab. 30. fig. 14.)

In tropical countries, and also in Spain. Its bite causes dangerous inflammation.

2. *Lagura*. S. pedibus utrinque 24, corpore ovali, cauda penicillo albo.

(*Mem. présentés à l'Ac. des Sc.* T. 1. Tab. 17.)

Under the bark of old trees, moss, mushrooms, &c. It is remarkable, that various Species of this and the following Genus obtain their numerous legs by degrees, bringing only a few pairs into the world with them.

3. *Electrica*. S. pedibus utrinque 70.

(FRISCH. p. 11. Tab. 2, 8. fig. 1.)

Very phosphorescent, and even the place where it has rested shines for a certain time. It lives chiefly in moist ground, but sometimes creeps into flowers, and in this way may be explained the not uncommon cases, in which this animal has penetrated the frontal sinuses of men, and caused intolerable headache, &c. for many years.

87. *IULUS*. Pedes numerosi : duplo utrinque plures quam corporis segmenta. Antennæ moniliformes. Palpi
2 articulati. Corpus semicylindricum.

1. *Terrester*. The Centipede.—T. pedibus utrinque 100.

(SULZER's *Gesch.* Tab. 30. fig. 16.)

Principally in rich ground or dung. Very injurious to the various kinds of cabbage.

SECT. IX.

OF WORMS.

§ 146. The characters of Insects are so distinct and intelligible—those of Worms, on the contrary, so vague, and so far from positive, that the shortest way of defining the latter might perhaps be as animals with white blood, not Insects; differing from them by the deficiency as well of antennæ as of articulated organs of motion. (§ 40. 122.)

§ 147. They have, for the most part, soft gelatinous bodies, a few only being covered with hair, as the Aphrodites, or with a calcareous shell, as the Sea-hedgehog. Many Amphitrites construct an artificial shell of grains of sand, &c.; whilst many other animals of this Class, viz. the Testacea and certain Polypes, inhabit a solid house resembling porcelain or stone, congenital, and serving the purposes of residence and defence; in some cases it is carried about by the animal, in others is firmly attached to one spot.

§ 148. No animal of this Class has wings, for the springing of the Cuttle-fish out of the water, is not to be called flying; neither has any true legs for the support of the body, or for motion. Earth Worms, Sea Hedgehogs, Sea Anemones, &c., have, however, particular organs, which in some degree answer similar purposes. In many instances too, the deficiency of external organs of motion in Worms, is supplied by the power which they possess of alternately elongating and shortening themselves.

§ 149. Instead of *Antennæ*, many Worms have *Tentacula*, soft, fleshy cords or fibres attached to the head, flexible, *not articulated*, in some cases of considerable length, and serving a variety of purposes; sometimes for touching, at others for taking their prey, and so forth.

§ 150. Of the Senses of these animals, and the organs devoted to them, still less that is positive can be said than of those of Insects. Some have undoubtedly true eyes, as the Sepiæ, &c., and others, without having eyes, possess a most acute feeling of light.

§ 151. In their internal structure, most Worms differ as much from Insects as these do from red-blooded animals.

This Class also differs from the preceding one in this, that, to the best of my knowledge, no animal belonging to it undergoes a true metamorphosis, which is so generally the case among Insects.

§ 152. The abode of these animals is generally in water; and by far the greater part of them in the Ocean. Some live under ground; others exclusively in the living bodies of other animals, as the intestinal worms, seminal animalculæ, &c.

§ 153. Their remarkable powers of reproduction serves to ensure the preservation of many animals of this Class; and some, as the Animalcula of paste, the Wheel-animal, &c., possess a kind of revivescence, which appears to render them, in some degree, indestructible.

§ 154. The generality of the intestinal Worms of animals, and the Sepiæ excepted, by far the greater number of Worms, are true Hermaphrodites, of which each individual is capable of propagating the Species in one of the ways already mentioned. (§ 20.)

Remark. The mode of copulation in many animals of this Class is also very peculiar, as in the common Garden and Tree Snails, (*Helix arbustorum*, *nemoralis*, &c.) which at that time, are provided with a remarkable little dart, composed of calcareous matter, and having the shape of a four-edged lance. (Tab. 1. fig. 8.) This dart is fixed loosely in an opening in the neck, and when the two Snails meet, each presses its dart into the breast of the other, this mutual excitement being precursory to actual copulation.

§ 155. The vast numbers of marine animals in this Class, (§ 152.) particularly the Testacea and Corals, are of extreme importance to the general economy of Nature, inasmuch as they in the Ocean, in the same manner with Insects upon the Earth, (§ 143.) incessantly destroy, consume, and, as it were, metamorphose an infinite variety of noxious or superfluous substances. To man, they are in so far serviceable, that many, particularly of the Mollusca and Testacea, are eatable; some, as for instance, the *Venus mercenaria*, and *Mytilus bidens*, serving as a principal article of diet to many navigators and inhabitants of Sea coasts. The *purple dye* was procured from certain Shell-fish, more formerly than at present*. Ink and

* See PROF. SCHNEIDER'S *Essay* on this subject in the 2d Vol. of A. DE ULLOA'S *Memoirs on America*. Leipz. 1781. 8vo.

Indian-ink are procured from the peculiar fluid of the Cuttle-fish. The beard of certain Species of *Pinna* affords a kind of brown silk which may be manufactured. Many kinds of shells contain Pearls *. Red Coral is an important article of trade, particularly in the East Indies. Several kinds of Shells, either entire or divided, pass current as money among some remote nations. From portions of similar shells, the Iroquois, and other North American people, made their *Wampum*, which serves the purpose of records †. Many savage people use Muscle and Snail shells for drinking vessels, spoons, &c. The South Sea Islanders make from them ingenious hooks and a variety of other fishing-tackle. (§ 118.) The North-Western Americans point their harpoons with angular pieces of Muscle-shells.

In regard to works of art—mother of pearl and many muscle and snail shells are cut like *Onyx* into Cameos.—The Cuttle-fish bone is employed by artists and workmen.—Sponge serves a variety of domestic purposes.—Madrepore is employed for paving and building on the Coasts of the Red Sea.—Numerous Testacea (the shells) and Corals are burnt for lime.—Some large thin shells are used as glass in the South of China, and in India.—The shells of Testacea are among the most common ornaments of savage nations ‡.—Lastly, the Leech is of great importance in the treatment of certain diseases.

§ 156. Among the noxious animals of this Class are, in particular, the worms of the human body, which either live in the intestines, as the *Ascarides*, *Toeniæ*, &c., or as the Guinea-

* Particularly the *Mytilus margaritifer*, *Mya margaritifera*, &c. The Pearls are mostly found in the animal itself, but occasionally in the shell. The mode of their origin is still obscure. The finest are procured from Ceylon and the Gulf of Persia. Those from the West Indies, California, Otaheite, &c., are less perfect, and still less so, most of those from the rivers of Europe. But even among these, and in particular those found at Celle and in Livonia, there are a certain number of uncommon beauty and perfection.

† See LOSKIEL's *History of the Moravian Mission in North America*, p. 34, &c.

‡ In the great collection of objects from the South Seas, presented to the Academical Museum of this place (Göttingen), by his late Majesty, is, among other articles, a necklace of neat shells, carefully polished, bored, and ingeniously twisted together with tendons, all the work of a race of men commonly considered as the most wretched outcasts of the human species, viz. the natives of the *Tierra del Fuego*.

worm immediately under the skin *. Others of a similar character, are the Flukes found in sheep, the Hydatids of swine, and the worms found in many quadrupeds and fishes, producing disease. Earth Worms and Snails are injurious to plants. Certain Species of the Genera *Teredo* and *Pholas* perforate ships and dams.

§ 157. In this Class I have, with a few exceptions, followed the arrangement of LINNÆUS.

ORDER I. *INTESTINA*. Long Worms without any evident external organs of motion.

II. *MOLLUSCA*. Naked, soft Worms, with visible, and often very numerous extremities: many of them have a considerable resemblance to the animals of the next Order.

III. *TESTACEA*. Animals inhabiting shells, and much resembling those of the preceding Order.

IV. *CRUSTACEA*. Animals having almost cartilaginous bodies, and in some cases with a firm or calcareous crust. Sea-hedgehogs, Sea-stars, &c.

V. *CORALLIA*. Polypes and other Zoophytes inhabiting coral branches and similar structures.

VI. *ZOOPHYTA*. Naked, plant-like animals, without any habitations: also the animalculæ of Infusions.

On the Natural History of Worms.

J. B. LAMARCK, *Système des Animaux sans vertébrés*. Paris, 1801. 8vo.

J. G. BRUGUIERE, *Histoire Naturelle des Vers*, in the *Encyclopédie Methodique*. Paris, 1789. 4to.

O. F. MULLER, *Historia Vermium Terrestrium et Fluvatilium*. Havn. 1773. 4to.

ALB. SEBA, *Thesaurus*. Vol. III.

A. F. SCHWEIGGER's *Handbuch der N. G. Skelettlosen ungegliederten Thiere*. Leipz. 1820. 8vo.

* I place no kind of faith in the tales related of the *Furia infernalis*, a little worm not known to have been ever seen, and yet minutely described, flying without wings, precipitating itself on men and cattle and causing immediate death.

I. INTESTINA.

Most of them have a cylindrical or ribbon-like body. The intestinal Worms of the human body, the spermatic Animalcules excepted, all belong to this Order *.

1. GORDIUS. Hair-worm. Ger. Fadenwurm.—Corpus filiforme, teres, æquale, læve.

1. *Aquaticus*. (Seta equina.) *G. pallidus* extremitatibus nigris.

A span long, and as thick as strong twine. In muddy ground and in water. Occasionally also like the following tropical Species, in the ulcers of men.

2. *Medinensis*. (Dracunculus. Vena Medinensis.) The Guinea-worm.—*G. totus pallidus*.

(SLOANE. *Nat. Hist. of Jamaica*. Vol. II. Tab. 134. fig. 1.)

On the Coasts of the Persian Gulf, in Egypt, the East and West Indies, Guinea, &c. It is as much as three feet in length. It shews itself under the skin, particularly about the ancles, knees, elbows, &c., where it causes painful boils, inflammation, &c. In extracting it, great care is necessary to avoid breaking it, an operation of this kind often lasting for several weeks †.

2. ASCARIS. Corpus æquale teres ore trinodo, intestinis conspicuis.

1. *Vermicularis*. A. cauda subulata, cute ad latera corporis subtilissime crenata.

* J. A. E. GOEZE, *Versuch einer N. G. der Eingeweidewürmer thierischer Körper*. Blankenburg, 1782. 4to.

Nachträge dazu, von J. G. H. ZEDER. Leipz. 1800. 4to.

Vermium Intestinalium præsertim tæniæ Humanæ brevis expositio, auctore P. C. WERNERO. Lips. 1782. 8vo.—with the *Continuatio*. Ib. 1782. seq. 8vo.

J. G. H. ZEDER's *Naturgeschichte der Eingeweidewürmer*. Bamberg, 1803. 8vo. But above all C. A. RUDOLPHI. *Entozoorum sive Vermium Intestinalium Historia Naturalis*. Amst. 1808. 2 Vols. 8vo. EJ. *Entozoorum Synopsis*. Berol. 1819. 8vo. with plates.—And J. G. BREMSER, *über lebende Würmer in lebenden Menschen*. Wien., 1819. 4to. with plates.

† On this celebrated animal, besides the above classical works, see KEMPFFER, *Amœitæ*. exotic. p. 526.

WINTERBOTTOM, *on the native Africans in the neighbourhood of Sierra Leone*. Vol. II. p. 82.

And particularly six different Essays in the *Edinburgh Medical and Surgical Journal*, Vol. II. 1806.—at p. 302 of which it is stated that the worm, if extracted entire and at one time, moves and shows signs of life.

Lives in the rectum of man, and sucks with its obtuse extremity.

2. *Lumbricoides*. (*Lumbricus teres*.) The Round Worm.—

A. cauda obtusa, ani rima transversa, intestino aurantio.

The most common of human intestinal Worms: found principally in the small intestines, and sometimes in vast numbers.

3. *TRICHOCEPHALUS*. Corpus inæquale, teres; antice capillare, postice incrassatum.

1. *Dispar*. T. supra subcrenatus, subtus lævis, anterieus subtilissime striatus.

In the large intestines of man; sucks with its small capillary extremity.

4. *ECHINORHYNCHUS*. Corpus teres, proboscide cylindrica retractyli echinata.

1. *Gigas*. E. candidus, collo nudo, proboscide vaginata: aculeorum uncinatorum ordinibus pluribus, papillis suctionis senis.

(GOEZE *Eingeweidewürmer*, Tab. 10. fig. 1, 6.)

In the intestines of the domestic hog.

5. *LUMBRICUS*. Corpus teres annulatum, longitudinaliter exasperatum aculeis conditis.

1. *Terrester*. The Earth Worm. *Ger.* der Regenwurm.—*L. ephippio circulari*, 8 seriebus aculeorum abdominalium.

The well known animal so injurious to young vegetables. A true subterraneous animal, under the skin of which another Species of intestinal worm (*Ascaris minutissima*) fixes itself.

2. *Variegatus*. L. rufus, fusco-maculatus, sexfariam aculeatus.

(BONNET. *Tr. d'Insectol.* 2. (Œuvr. Vol. I.) Tab. 1. fig. 1, 4.)

A beautifully coloured animal, about an inch and a half long, and living in ditches, graves, &c. It, as well as the common Earth Worm, has great powers of reproduction. A twenty-sixth part of the animal cut off, is formed within a few months into a perfect one of its original length. Its natural increase is effected either by producing living young ones, or casting them off like buds.

6. *FASCIOLA*. Corpus gelatinosum, planiusculum, poro ventrali duplici.

1. *Hepatica*. The Fluke. *Ger.* die Egelschnecke. *Fr.* la Douve.—F. depressa, ovata fusca, antice tubulo instructa.

(J. C. SCHAFFER'S *Egelschnecken*. fig. 1, 8.)

In the biliary ducts of the Sheep, and many other herbivorous quadrupeds.

2. *Intestinalis*. F. corpore tæniolari marginibus undulatis.

(*Journal des Savans*. 1726. p. 102.)

Like a small ribband, and not articulated. Found in the abdomen of many fishes, and even alive after they have been cooked.

7. *Tænia*. (*Lumbricus latus*.) Tape-worm. Ger. Bandwurm.

Fr. Ver solitaire.—Corpus planiusculum, geniculatum.

Os quadrilobum.

An extensive Genus, notable as well for the peculiarities of its structure, as for the obstinacy and variety of the symptoms which the undermentioned Species cause in the human body. This worm is articulated, and attaches itself to the intestinal canal, by means of the pointed proboscis projecting from its head with four lobes*. Next to the head, at least in the following Species, is a small, almost thread-like neck, the joints of which become gradually larger as they approach the body. In each of the larger joints, which form by far the greater part of the animal, is an ovarium, generally of a very elegant form, foliated, &c., and from which the ova escape through one or two openings placed at the edge or on the flat surface of the animal. This worm is by no means *solitaire*, several of them being often found in a single man or beast.

1. *Solium*. T. humana articulis oblongis, orificio marginali solitario, ovario pinnato.

This Species is the most common in Germany. As well as the next, it is found in the small intestines of man.

The *Vermes cucurbitini*, *Ascarides* COULETI, are the detached posterior joints of this animal.

2. *Vulgaris*. (*Bothriocephalus latus*†.) T. humana articulis abbreviatis transversis, orificio laterali duplici, ovario stellato.

In other parts of Europe. Very common in Switzerland and France.

* It appears that a new head is formed when portions are torn off the anterior extremity of *Tæniæ*. See Sir A. CARLISLE's valuable observations in Vol. II. of the *Transactions of the Linnean Society*, p. 256.

† On certain Species of *Tænia*, formed into a Genus under the name of *Bothriocephali*,—see Dr. LEUCKART's *Zoologische Bruchstücke*. 1. Helmst., 1820. 4to.

8. *HYDATIS*. Corpus tæniforme desinens in vesicam lymphaticam. Os quadrilobum.

The head and forepart of these very remarkable animals, which are mostly found in the viscera of various mammifera, bear a considerable resemblance to those of the tape-worms. Their posterior extremity terminates in an oval bladder of various size.

1. *Finna*. (*Cysticerus cellulosa*. RUDOLPHI.) H. conica, vesicæ duplici inclusa, interiori basi sua adhærens, capite versus collum vesicæ directo.

(*Abbild. Nat. Hist. Gegenst.* Tab. 39.)

Rarely found in the muscles, brain, &c. of man* and apes. On the contrary, very common in hog's flesh.—MALPIGHI established its animal nature beyond all doubt. The fact of its being found in the swine which man has domesticated, and not in the wild race, appears to furnish an instance of organized bodies which have been formed long after the general creation.

2. *Globosa*. H. simplex ovata, corpore distincte articulado, rugoso, imbricato.

(*Goeze. Eingeweidewürmer.* Tab. 17.)

The bladder is often larger than a hen's egg. It is very common in the liver and peritoneum of swine.

3. *Cerebralis*. H. multiplex, corpusculis pluribus, cauda biseta vesicæ communi adnatis.

(*Leske vom Drehen der Schafe.* Leipz., 1780. 8vo.)

In the brain of Sheep affected with the staggers.

4. *Erratica*. H. multiplex, corpusculis pluribus, ovatis vesicæ communi innatantibus.

(*Abbild. Nat. Hist. Gegenst.* Tab. 79.)

I found this Species in the tumid Hydatids contained in the viscera of a Macaco. (*Simia cynomolgus*.)

9. *SIPUNCULUS*. Corpus teres elongatum. Os anticum, attenuatum, cylindricum. Apertura lateralis corporis verruciformis.

1. *Saccatus*. (*Vermis microrhynchoterus*.) S. corpore tunica laxa induto.

(*C. Gesner. Hist. aquatil.* p. 1226.)

In the East Indian Seas.

* See HIMLY, in the *Journal der Practischen Arzneykunde*. 1809. B. 2. St. 12. p. 115. Tab. 1, 3.

10. *HIRUDO*. Leech. *Ger.* Blutegel. *Fr.* Sangsue.—*Corpus oblongum, promovens se ore caudaque in orbiculum dilatandis**.

1. *Medicinalis*. *H. depressa nigricans, supra lineis flavis 6: intermediis nigro-arcuatis, subtus cinerea nigro maculata.*

(DILLENIIUS, in *Eph. N. C.* Cent. 7. Tab. 5.)

The most serviceable Species for blood-letting†, and on that account a considerable article of trade in some places.

2. *Octoculata*. *H. depressa fusca, punctis 8 nigris supra os.*

(Schwed. *Abhandl.* 1757. Tab. 6. fig. 5, 8.)

It lays a single egg, which at first contains only lymph, but producing 8, 10, or more young ones.

II. MOLLUSCA.

Naked Worms, distinguished from those in the preceding Order, by having a more slimy body, and more evident external limbs. Many of them bear a considerable resemblance to the animals occupying shells‡.

11. *LIMAX*. Slug. *Ger.* Weg-Schnecke. *Fr.* Limace.—

Corpus oblongum, repens: supra clypeo carnosio; subtus disco longitudinali plano; foramen laterale dextrum pro genitalibus et excrementis. Tentacula 4 supra os.

These Slugs, in common with the snails inhabiting shells, have great powers of reproduction.

1. *Ater*. *L. ater.*

(LISTER. *ex edit.* HUDDSFORDI. Tab. 101. fig. 102.)

2. *Rufus*. *L. subrufus.*

(LISTER. Tab. 101. a. fig. 103.)

3. *Maximus*. *L. cinereus maculatus.*

(LISTER. Tab. 101. a. fig. 104.)

* J. F. P. BRAUN'S *Systematische Beschreibung einiger Egelarten*. Berl., 1805. 4to.

† P. THOMAS, *Histoire Naturelle des Sangsues*. Paris, 1806. 8vo.

J. R. JOHNSON on the *Medicinal Leech*. London, 1817. 8vo.

‡ On this imperfectly known Order, consult among others,—

J. B. BOHADSCH, *de quibusdam animalibus marinis*. Dresd., 1761. 4to.

And in *German with Remarks* by N. G. LESKE. Ibid. 1776. 4to.

PETR. FORSKÅL, *icones rerum naturalium, quas in itinere Orientali depingi curavit*. Edidit CARST. NIEBUHR. Havn., 1776. fol.

O. F. MULLER, *icones Zoologiæ Danicæ*. Ibid. 1777. seq. fol.

L. A. G. BOSC, *Histoire Naturelle des vers*. Paris, 1801. Vol. III. 8vo.—

And D'AUDEBARD DE FERUSSAC, *Histoire Naturelle des Mollusques terrestres et fluviatiles*. Paris, 1819, &c. fol. With plates.

4. *Agrestis*. *L. cinereus immaculatus*.

(LISTER. Tab. 101. fig. 101.)

All, particularly in wet years, injurious to the produce of the Earth*.

12. *APLYSIA*. *Corpus repens*. Clypeo dorsali membranaceo. Foramen laterale dextrum pro genitalibus. Anus supra extremitatem dorsi.

1. *Depilans*. (*Lepus marinus* of the ancients.) A. tentaculis 4. (PENNANT'S *Brit. Zool.* 4. Tab. 21. fig. 21.)

Together with the following animal, in the Mediterranean.

13. *DORIS*. *Corpus repens*, oblongum, subtus planum. Os antice subtus. Anus postice, supra cinctus ciliis. Tentacula 2, supra corpus antice, intra foramina retractilia.

1. *Argo*. *D. ovalis*, corpore lævi, tentaculis 2 ad os, ano ciliato phrygio.

(PENNANT. 1. c. Tab. 22. fig. 22.)

14. *GLAUCUS*. *Corpus oblongum*, pertusum foraminulis lateralibus duobus. Tentacula 4. Brachia 8 palmata.

1. *Atlanticus*. (*Abbild. Nat. Hist. Gegenst.* Tab. 48.)

In the Atlantic and Indian Oceans.

15. *APHRODITA*. *Corpus repens*, oblongum, subdepressum, articulatum : articuli utrinque fasciculati, setiferi, pilosi. Os retractile. Tentacula 2 annulata.

1. *Aculeata*. The Sea Mouse. *Ger.* der Goldwurm. *Fr.* la Taupe de Mer.—A. *ovalis hirsuta aculeata*, pedibus utrinque 32.

(SWAMMERDAM. *Bibl. Nat.* Tab. 10. fig. 8.)

In the North Sea and others. The prickles and hair, with which it is beset on both sides, glitter, especially in the sun-shine, like fire or the blue flame of sulphur, &c.

16. *AMPHITRITE*. *Corpus protensum in tubulo*, annulatum. Pedunculi verrucosi. Tentacula acuminata, approximata, plumosa.

1. *Auricoma*. A. cirris binis utrinque, anterieus tentaculis pectiniformibus auratis rigidis.

(PALLAS. *Miscell. Zoolog.* Tab. 9. fig. 3.)

In the North Sea, &c. This and some other Species of the Genus inhabit very delicate, conical structures, which are ge-

* See in the Hanoverian Magazine for 1820, J. C. LEUCH'S Essay, which obtained the Prize of the Royal Society of Göttingen.

nerally formed in a very singular way of a single layer of innumerable grains of sand placed close together.

17. *NEREIS*. Corpus repens oblongum lineare. Pedunculi laterales penicillati. Tentacula simplicia.

1. *Noctiluca*. N. segmentis 23, corpore vix conspicuo.

In sea-water, to the shining of which by night it may perhaps contribute.

18. *NAIS*. Corpus lineare pellucidum, depressum, setis pedunculatum. Tentacula nulla.

These animals propagate in a singular manner*: the last joint gradually extends and increases to a full sized animal, which after a certain time separates from the body of the old Nais, or even previously shoots out other young ones from its own last joint in a similar way. At the same time, many Species, the following for instance, produce young ones from an ovarium impregnated by copulation.

1. *Proboscidea*. (*Nereis lacustris*. LINN.) N. setis lateralibus solitariis, proboscide longa.

(RÜSEL. *Hist. der Polypen*. Tab. 78. fig. 16, 17.)

19. *ASCIDIA*. Corpus fixum teretiusculum, vaginans. Aperturæ binæ ad summitatem: altera humiliore.

They are attached to rocks on the shore, and can jerk out water in long jets.

1. *Intestinalis*. A. lævis alba membranacea.

In the North Sea, as is also the next animal.

20. *ACTINIA*. Sea Anemone. (*Urtica marina*.) Corpus se affigens basi, oblongum, teres, apicis margine dilatabili intus tentaculato, os terminale centrale ambi-ente.

Have remarkable reproductive powers.

1. *Senilis*. A. subcylindrica transverse rugosa.

(*Phil. Trans.* Vol. LXIII. Tab. 16, fig. 10. &c.)

21. *TETHYS*. Corpus liberum, oblongiusculum, carnosum, apodum. Os proboscide terminali, cylindrico, sub labio explicato. Foramina 2 ad latus colli sinistrum.

1. *Leporina*. (*Lepus marinus major* COLUMNÆ.) T. labro ciliato.

(FAB. COLUMNA. l. c. p. 26.)

In the Mediterranean.

* O. F. MULLER, *von Würmern des Süßen und Salzigen Wassers*, Copenh. 1771. 4to.

22. **HOLOTHURIA.** Corpus liberum, vesicam oblongam æream referens, dorso cristato velificans. Tentacula abdominalia numerosa filiformia, pendula, cava, ore terminali peltato instructa*.

1. *Physalis.* The Portuguese Man of War.—H. corpore pyriformi, rostro conico, tentaculis longissimis.

(V. KRUSENSTERN'S *Atlas*, Tab. 23.)

In the Atlantic Ocean, &c. The body is about the size of a fist, composed of a very delicate membrane varying in colour from blue to red, and filled with air. From it are stretched very long and extensible fibres, which, when touched, sting more acutely than nettles. Along the back of the bladder is a membrane for sailing, which the animal when swimming places according to the direction of the wind.

23. **THALIA.** (Salpa.) Corpus liberum, oblongum, gelatinosum diaphanum. Tubus alimentarius distinctus: tentacula nulla.

1. *Lingulata.* Th. corpore depresso, antice in apicem acutum desinente.

(*Abbild. Nat. Hist. Gegenst.* Tab. 30.)

In the Atlantic Ocean. (See ADELB. DE CHAMISSO *De Salpa*. Berol., 1819. 4to.)

24. **TEREBELLA.** Corpus filiforme. Os anticum, præputio glandem pedunculatam tubulosam exserente. Tentacula circum os, capillaria, plura.

1. *Lapidaria.* T. cirris ad anteriora corporis 8; circa os 4.

(*Schwed. Abhandl.* 1754. Tab. 3. fig. A—E.)

In the Mediterranean.

25. **LERNÆA.** Corpus se affigens tentaculis, oblongum terebretiusculum. Ovaria bina. Tentacula brachiformia.

Noxious vermin of fish, in the gills of which they fix themselves.

1. *Cyprinacea.* L. corpore obclavato, thorace cylindrico bifurco, tentaculis apice lunatis.

(LINNÆI *Fauna Suec.* Tab. 2. fig. 2100.)

26. **SCYLLÆA.** Corpus se affigens, compressum, dorso canaliculato. Os foramine edentulo, terminali. Tentacula sive branchia subtus trium parium.

1. *Pelagica.* (SEBA *Thesaur.* Vol. I. Tab. 74. fig. 7.)

Principally upon the *Fucus natans*.

* See the Circumnavigator TILESIIUS'S Monography in A. J. von KRUSENSTERN'S *Reise um die Welt.* Th. 3. p. 1.

27. CLIO. Corpus natans, oblongum. Pinnis duabus membranaceis, oppositis.

1. *Limacina*. C. nuda corpore obconico.

(ELLIS and SOLANDER. Tab. 15. fig. 9, 10.)

Near Spitzbergen, Newfoundland, &c. This and some similar Species in the Northern Seas, make almost the whole of the food of the Whale. (*Balæna mysticetus*.)

28. SEPIA. Cuttle-fish. Ger. Tintenfisch. Fr. Séche. Brachia 8 interius adpersa cotyledonibus. Rostrum inter brachia terminale, corneum. Venter (plerisque) vesica atramentifera instructus, infra scissura transversa ad basin apertus, supra quam fistula excretoria eminet.

The Cuttle-fish are found in most parts of the Ocean*, and differ in many respects from the other animals of this Class, particularly with respect to their internal structure, the perfect formation of their viscera, organs of generation, eyes, and even organs of hearing, described by Mr. J. HUNTER and others.

The number of processes on their arms increases with the age of the animal, and in some Species amounts to upwards of 1,000. By means of them, they fix themselves in the manner of cupping glasses. They have the power of reproducing their arms, which are often torn or nipped off by shell and other fishes, a fact with which the ancients were acquainted. Most of the Species too, are remarkable for the blackish brown fluid, contained in a particular receptacle on the abdomen, which they can eject at pleasure, and by that means darken the water in their vicinity. It formed the ink of the ancient Romans, and is probably the principal ingredient of the Chinese or Indian ink. Professor SCHNEIDER has divided the Genus into the two following families :—

(A.) *Promuscidibus binis; ventre pinnato; ossiculo dorsi*.

1. *Officinalis*. S. ventre latissimo rotundato undique pinna cincto, osse dorsali maximo.

(SWAMMERDAM. *Bibl. Nat.* Tab. 50. fig. 1.)

It is principally from this Species that the *os Sepiæ* is obtained, which is a large bony plate of remarkable texture in the back of the animal. Many kinds of Sea Grapes, as they are called, (*Uvæ marinæ*,) are the ovaria of this and similar Species.

* J. G. SCHNEIDER, *Sammlung vermischter Abhandl. zur Zoologie und Handlungsgeschichte*. Berlin, 1784. 4to. S. 7—134.

2. *Loligo*. The Calmar.—S. ventre stricto subulato, pinna angulari media, osse dorsali penniformi.

(PENNANT'S *Brit. Zool.* 4. Tab. 27. fig. 43.)

(B.) *Pedibus basi palmatis, absque promuscidibus, pinnis et osse dorsali.*

3. *Octopodia*. (Polypus.) S. acetabulorum in interna pedum superficie ordine duplici, in basi singulis acetabulis, paulatim incrementibus.

(PENNANT. 1. c. Tab. 28. fig. 44.)

This Species, esteemed for its well tasted flesh, is found in many places, and particularly of a large size in the East Indies and Gulf of Mexico.

29. MEDUSA. Sea-blubber. *Ger. Qualle*.—Corpus gelatinosum, orbiculatum, supra convexum, subtus cavum. Os inferum, centrale, labiatum. Tentacula plerisque marginalia, saepius retractilia*.

Many Species contribute to the phosphorescence of the Sea†.

1. *Æquorea*. M. orbicularis planiuscula, margine inflexo villosa tentaculato.

(BASTER. *Op. subsec. 2.* Tab. 5. fig. 2, 3.)

In the North Sea, &c.

2. *Velella*. M. ovalis concentricè striata, margine ciliato, supra velo membranaceo.

(FAB. COLUMNA. 1. c. p. 22.)

3. *Octostyla*. M. hemisphærica, marginis tentaculis nullis, subtus columna quadruplicata: apice lobis 8 multifidis, laterumque appendicibus 16.

(FORSKAL *icones.* Tab. 30.)

In the Red Sea. About a span long, and of a most beautiful violet blue colour.

III. TESTACEA.

In this very extensive Order, two principal objects are distinguished, viz. the shells and the animals inhabiting them. The latter are of very various forms; but for the most part resemble the Worms of the preceding Order. The Shells consist originally of a membranous, sometimes almost horny layer, which acquires firmness by the calcareous matter gradually deposited in it. The newly formed Snail-shells, however, have

* TILESIIUS, in *Jahrbuch der N. G.* 1. S. 166., &c.

† MITCHILL, in ALBER'S *Americanischen Annalen.* 1. S. 119, &c.

not, according to the observations of REAUMUR, KAEMMERER, and others, their entire number of turns, but are gradually formed as the creature increases, and attached to the edge of the opening of the Shell; not as if they were developed from a previous germ. *Ceteris paribus*, the same is the case with other shells. Many of these Shells are deserving of notice for their wonderful structure*, others for their glittering, porcelain-like glazing, for their splendid colours, their regular and delicate marks, with other beauties of the same kind. The colours of many when polished, are very different from those of the natural surface†.

* J. S. SCHRÖTER, *Über den innern Bau der See und andern Schnecken*. Frankf. 1783. 4to.

† Among the principal works on this (according to the common methods, not the most profitable,) part of Natural History, are:—MART. LISTER, *Synopsis Methodica Conchyliorum*. Lond. 1685. seq. fol.—ED. 2. (recensuit et indicibus auxit GU. HUDDSFORD.) Oxon. 1770. fol.

Index Testarum Conchyliorum, quæ adservantur in Museo NIC. GUALTIERI. Florent. 1742. fol.

DESALL. D'ARGENVILLE, *Conchyliologie*. Paris, 1757. 4to.—ED. 3. par DE FAVANNE, DE MONTCERVELLE. Ib. 1780. 4to.

F. M. REGENFUSS, *Sammlung von Muscheln, Schnecken, &c.* Copenhagen, 1758. Gr. fol.

J. H. W. MARTINI, *Systematisches Conchylien-Cabinet*. (fortgesetzt durch J. H. CHEMNITZ.) Nürnberg. 1768. seq. B. 9. 4to.

IGN. ABORN, *Testacea Musei Cæsarei Vindobonensis*. Vindob. 1780. fol.

C. SCHREIBER'S *Versuch einer Vollständigen Conchylienkenntniss, nach LINNE'S System*. Wien. 1793. 2 Vols. 8vo.

L. A. G. BOSC, *Histoire Naturelle des Coquilles*. Paris, 1802. 5 Vols. 8vo.

C. F. SCHUMACHER, *Essai d'un Nouveau Système des vers Testacés*. Copenh. 1817. 4to.—With plates.

F. C. SCHMIDT'S *Versuch über die beste Einrichtung der Conchylien-Sammlungen, &c.* Gotha. 1818. fol.

ADOLPH. MURRAY, *Fundamenta Testaceologiæ*. Upsal. 1771. 4to. (And in LINNE'S *Amoenitat. Acad.* Vol. VIII.)

C. L. KAEMMERER, *Conchylien im Cabinette des Erbpr. von Schwarzburg-Rudolstadt*. Rudolst. 1786. 8vo.

J. P. R. DRAPARNAUD, *Histoire Naturelle des Mollusques Terrestres et Fluviatiles de la France*. Paris. 1806. 4to.

TH. MARTYN'S *Figures of Shells collected in the different Voyages to the South Seas*. Lond. 1784. Gr. fol.

JOS. XAV. POLI, *Testacea utriusque Siciliæ eorumque Historia et Anatome*. Pamæ. 1791. Vol. II. fol.

Many of the Species of several Genera of Muscles and Snails are covered with an external organized membrane, which must not be confounded with the Millepora, &c., attached to them.

This extensive Order is divided into three Families, according to the number and form of the shells :—

- (A.) Multivalve Testacea.
- (B.) Bivalve, Muscles, &c.
- (C.) Univalve, with regular windings, Snails.
- (D.) Univalves, without such windings.

(A.) MULTIVALVES.

Live in the sea only.

30. CHITON. Testæ plures, longitudinaliter digestæ, dorso incumbentes.

1. *Tuberculatus*. C. testa septem-valvi, corpore tuberculato.

31. LEPAS. Acorn-shell.—Animal rostro involuto spirali, tentaculis cristatis. Testa multivalvis, inæquivalvis.

Many Species, the two first for instance, are immoveably attached by their shells; others, on the contrary, as the two last, are suspended by a gut-like viscus, which is attached to any body near them:—a distinction so striking, as to authorize division into two Genera*.

(a.) Sessiles.

1. *Balanus*. L. testa conica sulcata fixa, operculis acuminatis.

(CHEMNITZ. Vol. VIII. Tab. 97. fig. 820.)

In many parts of the World, on rocks, the bottoms of ships, muscles, crabs, &c.

2. *Ceti*. (Diadema.) L. testa subrotunda sex-lobata sulcata fixa.

(CHEMNITZ. Vol. VIII. Tab. 99. fig. 843.)

Together with some other Species of this Genus, on the skin of the Grampus, and some other Cetacea.

(b.) Pedate.

3. *Polliceps*. The Cornu-copia. Ger. die Fusszehe. Fr. le Pousse-pied.—L. testa valvis 20 (aut pluribus) polymorphis, intestino squamulis granato.

(CHEMNITZ. Vol. VIII. Tab. 100. fig. 351.)

* See TILESUS b. c. p. 222-419.

This very strangely formed creature is a native of the coasts of Barbary in particular.

4. *Anatifera*. The Barnacle. *Ger.* die Entenmuschel.—*L.* testa compressa quinquevalvi, intestino insidente lævi.

(*Abbild. Nat. Hist. Gegenst.* Tab. 68.)

It is principally known by the fabulous story already mentioned, when speaking of the Barnacle-geese. (p. 128.) The quinquevalve shell with its inhabitant, hangs by a fleshy gut-like tube, or even several, like twigs, from the stem formed by such a tube, which itself is attached to rotten wood, pieces of wreck, or the like.

32. *PHOLAS*. Pierce-stone. *Ger.* Bohrmuschel. *Fr.* Dail.—*Testa* bivalvis, divaricata, cum minoribus accessoriis difformibus ad cardinem. Cardo recurvatus, connexus cartilagine.

They bore passages in rocks, even in the hardest marble, in the stems of coral, Oyster-shells, the bottoms of ships, &c. and excavate a habitation at the termination of the passages.

1. *Dactylus*. *Ph.* testa oblonga hinc reticulato-striata.

(*CHEMNITZ*. Vol. VIII. Tab. 101. fig. 859.)

The animal shines with considerable splendour in the dark.

2. *Pusilla*. *Ph.* testa oblonga rotundata arcuato-striata.

(*SPENGLER* in *den Schriften der Berl. Naturf. Gesel.* 4 B. Tab. 6. fig. 1, 5.)

In many parts of the Ocean.

(B.) BIVALVES.—*CONCHÆ*. (*mollusca testacea acephala*.)

They all live in water. The principal distinctions of the Genera depend on the similarity or dissimilarity of their two shells, and their edges, together with the disposition of the hinge. (cardo.)

33. *MYA*. Muscle. *Ger.* Klaffmuschel. *Fr.* Moule.—*Testa* bivalvis, hians altera extremitate. Cardo dente (plerisque) solido, crasso, patulo, vacuo, nec inserto testæ oppositæ.

1. *Pictorum*. *M.* testa ovata, cardinis dente primario crenulato : laterali longitudinali : alterius duplicato.

(*CHEMNITZ*. Vol. VI. Tab. 1. fig. 6.)

2. *Margaritifera*. *M.* testa ovata antice coarctata, cardinis dente primario conico, natibus decorticatis.

(*CHEMNITZ*. Vol. VI. Tab. fig. 5.)

34. *SOLEN*. Razor-shell, *Ger.* Messerscheide, *Fr.* Coute-

lier.—Testa bivalvis, oblonga, utroque latere hians. Cardo dens subulatus, reflexus, sæpe duplex, non insertus testæ oppositæ : margo lateralis obsoletior.

1. *Siliqua*. S. testa lineari recta ; cardine altero bidentato.

(CHEMNITZ. Vol. VI. Tab. 4. fig. 29.)

35. *TELLINA*. Testa bivalvis, antice hinc ad alterum latus flexa. Cardo dentibus ternis : lateralibus planis alterius testæ.

1. *Radiata*. T. testa oblonga longitudinaliter subtilissime substriata nitida, sutura anali canaliculata.

(CHEMNITZ. Vol. VI. Tab. 11. fig. 102.)

2. *Cornea*. T. globosa, transversim striata, costa fusca transversali.

A common small fresh-water shell.

36. *CARDIUM*. Cockle.—Testa bivalvis, subæquilatera, æquivalvis. Cardo dentibus mediis binis alternatis ; lateralibus remotis insertis.

1. *Costatum*. C. testa gibba æquivalvi ; costis elevatis carinatis *concavis* tenuissimis.

(CHEMNITZ. Vol. VI. Tab. 15. fig. 151. seq.)

On the Coast of Guinea.

2. *Echinatum*. C. testa subcordata, sulcis exaratis linea ciliata aculeis inflexis plurimis.

(CHEMNITZ. Vol. VI. Tab. 15. fig. 158.)

3. *Edule*. C. testa antiquata, sulcis 26 obsolete recurvato-imbricatis.

(CHEMNITZ. Vol. VI. Tab. 19. fig. 194.)

Very abundant on the shores of the temperate parts of Europe.

37. *MACTRA*. Testa bivalvis inæquilatera, æquivalvis. Cardo dente medio complicato cum adjuncta foveola ; lateralibus remotis insertis.

1. *Solida*. M. testa opaca læviuscula subantiquata.

(CHEMNITZ. Vol. VI. Tab. 23. fig. 229.)

38. *DONAX*. Testa bivalvis, margine antico obtusissimo. Cardo dentibus duobus : marginalique solitario, subremoto, sub ano.

1. *Scripta*. D. testa ovata compressa lævi, scripta lineis purpureis undatis, rima acuta, marginibus crenulatis.

(CHEMNITZ. Vol. VI. Tab. 26. fig. 261.)

39. *VENUS*. Testa bivalvis, labiis margine antico incumbentibus. Cardo dentibus 3 omnibus approximatis, lateralibus apice divergentibus.

1. *Dione*. V. testa subcordata, transverse sulcata, antrorsum spinosa.

(CHEMNITZ. Vol. VI. Tab. 27. fig. 271.)

2. *Mercenaria*. The Clam. Wampum.—V. testa cordata solida transverse substriata lævi, margine crenulato, intus violacea, ano ovato.

(Abbild. Nat. Hist. Gegenst. Tab. 69.)

It has very thick, heavy shells, with which the North American Savages divide corals for their records, ornaments, &c., and in their long journeys chew the contained animal.

3. *Tigerina*. V. testa lentiformi: striis crenatis decussatis, ano impresso ovato.

(CHEMNITZ. Vol. VI. Tab. 37. fig. 390.)

40. SPONDYLUS. Testa inæquivalvis, rigida. Cardo dentibus 2 recurvis, cum foraminulo intermedio.

1. *Gæderopus*. S. testa subaurita spinosa.

(CHEMNITZ. Vol. VII. Tab. 44. fig. 459.)

One of the shells posteriorly near the joint extends much beyond the other, and is jagged. The nature of the joint is also remarkable, the teeth being locked in such a manner as to allow the shells to be opened, but not to be detached from one another, as long as the hinge remains perfect.

41. CHAMA. Clam. Ger. Gienmuschel.—Testa bivalvis: crassior. Cardo callo gibbo, oblique inserto fossula obliquæ.

1. *Cor*. C. testa subrotunda lævi, processibus retrorsum recurvatis, rima hiantæ.

(CHEMNITZ. Vol. VII. Tab. 48. fig. 483.)

2. *Gigas*. (Kima.) C. testa plicata, fornicata, squamosa.

(CHEMNITZ. Vol. VII. Tab. 49. fig. 492.)

The largest of the Testacea known, its shell weighing full six hundred weight, and its flesh thirty pounds. The latter is eaten by the inhabitants of the East Indian Islands, and of the coasts of the Red Sea.

3. *Gryphoides*. C. testa orbiculata, muricata; valvula altera planiore; altera nate productiore subspirali.

(CHEMNITZ. Vol. VII. Tab. 51. fig. 110.)

4. *Bicornis*. C. testa valvulis conicis, natibus cuneiformibus obliquis tubulosis valvula longioribus.

(CHEMNITZ. Vol. VII. Tab. 52. fig. 516. seq.)

42. ARCA. Testa bivalvis, æquivalvis. Cardo dentibus numerosis, acutis, alternis insertis.

1. *Noæ*. The Ark.—A. testa oblonga striata apice emarginati, processibus incurvis remotissimis, margine integerrimo hiantē.

(CHEMNITZ. Vol. VII. Tab. 53. fig. 529.)

2. *Pilosa*. A. testa suborbiculata æquilatera pilosa, natibus incurvis : margine crenato.

(POLI. T. 2. Tab. 26. fig. 1-4.)

In the Mediterranean Sea. The shells are covered with a vellum-like layer, particularly on the outer edge.

43. *OSTREA*. Oyster. *Ger.* Auster. *Fr.* Huitre.—Testa bivalvis, inæquivalvis, (plerisque) subaurita. Cardio edentulus fossula cava ovata ; striisque lateralibus transversis.

The very different Species of this Genus might be conveniently divided into two others ; one, to which the two first Species belong, including the Scallops ; the other, Oysters, properly so called.

3. *Pleuronectes*. O. testa æquivalvi radiis 12 duplicatis, extus lævi.

(CHEMNITZ. Vol. VII. Tab. 61. fig. 595.)

2. *Pallium*. O. testa æquivalvi radiis 12 convexis, striata scabra squamis imbricata.

(CHEMNITZ. Vol. VII. Tab. 64. fig. 607.)

3. *Malleus*. O. testa æquivalvi triloba, lobis transversis.

(CHEMNITZ. Vol. VIII. Tab. 70. fig. 655.)

4. *Folium*. O. testa inæquivalvi ovata, lateribus obtuse plicata parasitica.

(CHEMNITZ. Vol. VIII. Tab. 71. fig. 662.)

5. *Edulis*. The common Oyster.—O. testa inæquivalvi semi-oribiculata, membranis imbricatis undulatis, valvula altera plana integerrima.

Found principally on the Coasts of the North-West of Europe, and of the Mediterranean and Adriatic Seas, on banks, in respect to which and the differences of flavour, the distinctions are made of hill, sand, and clay Oysters *.

6. *Ephippium*. O. testa æquivalvi orbiculata, compressa membranacea.

(CHEMNITZ. Vol. VII. Tab. 59. fig. 576.)

* See a notice of the principal Oyster-banks on the Coasts of Europe, in BECKMANN'S *Vorbereitung zur Waarenkunde*. B. 1. S. 93.—111.

In the Indian Ocean. It occasionally contains pearls, but generally of inferior colour and shape.

7. *Crista Galli*. O. testa æquivalvi plicata, spinosa, labro utroque scabro.

(CHEMNITZ. Vol. VIII. Tab. 75. fig. 683.)

44. *ANOMIA*. Testa inæquivalvis; valvula altera planiuscula (sæpe basi perforata), altera basi magis gibba. Cardo edentulus cicatricula lineari prominente, introrsum dente laterali. Radii 2 ossei pro basi animalis.

1. *Ephippium*. A. testa suborbiculata rugoso-plicata: planiore perforata.

(CHEMNITZ. Vol. VIII. Tab. 76. fig. 692.)

2. *Cepa*. A. testa abovata inæquali violacea: superiore convexa, inferiore perforata.

(CHEMNITZ. l. c. fig. 694.)

3. *Vitrea*. A. testa ovata, ventricosa, alba, tenerrima, valvula altera rostro incurvata, perforata. Margine acuto integerrimo, undique clauso.

(CHEMNITZ. l. c. fig. 707. seq.)

In the Mediterranean, the Atlantic Ocean, &c. One of the few marine animals of the present creation, which may be considered as the original of a really similar petrification, found in the strata of Transition Lime-stone.

45. *MYTILUS*. Muscle. *Ger.* Miesmuschel. *Fr.* Moule. —Testa bivalvis rudis, sæpius affixa bysso. Cardo edentulus, distinctus linea subulata excavata longitudinali.

1. *Margaritifera*. M. testa compresso-plana, suborbiculata, basi transversa imbricata tunicis dentatis.

(CHEMNITZ. Vol. VIII. Tab. 80. fig. 717. seq.)

Remarkable as well for the very fine pearls found in the animal, as for the Mother of Pearl afforded by the shells. From the tendinous band closing the shell, and which glitters like Labrador-stone, is cut, the so called *Gemma penna favonis*, or *helmintholithus androdamas*—LINN.

2. *Lithophagus*. M. testa cylindrica utrinque extremitatibus rotundatis.

(CHEMNITZ. Vol. VIII. Tab. 82. fig. 729. seq.)

Bore holes in rocks, coral-stems, &c.: even in the hardest marble, as is shewn by the celebrated, but mysterious pheno-

menon of the three large columns of *Cipollino antico*, in the Temple of Serapis, at Pozzuolo, which, though at a elevation of 27 feet above the level of the Mediterranean near them, are perforated in a circular manner by these animals. See P. A. PAOLI, *Antichità di Pozzuoli*. Tab. 15.

3. *Edulis*. M. testa læviuscula violacea, valvulis antice subcarinatis, postice retusis.

(CHEMNITZ. Vol. VIII. Tab. 84. fig. 750. seq.)

A doubtful kind of food, which has occasionally proved fatal.

4. *Bidens*. M. testa striata subcurvata, margine posteriore inflexo, cardine terminali bidentato.

(CHEMNITZ. Vol. VIII. Tab. 83. fig. 742. seq.)

5. *Modiolus*. M. testa lævi margine anteriore carinato, nati- bus gibbis cardine sublaterali.

(CHEMNITZ. Vol. VIII. Tab. 85. fig. 757.)

Particularly fine on the Coasts of New Guinea; but found also on the Coasts of the North of Europe.

46. PINNA. Sea-wing. Ger. Steckmuschel. Fr. Jambon.
—Testa subbivalvis, fragilis, erecta, emittens bar-
bam byssinam. Cardo edentulus, coalitis in unam
valvulis.

These Testacea are celebrated for their beard, by means of which they attach themselves, and from which gloves, &c. are manufactured at Smyrna, Tarentum, Palermo, &c.

1. *Rudis*. P. testa sulcata: squamis formicatis, per series digestis.

(CHEMNITZ. Vol. VIII. Tab. 88. fig. 773. seq.)

2. *Nobilis*. P. testa striata: squamis canaliculato-tabulosis subimbricatis.

(CHEMNITZ. Vol. VIII. Tab. 89. fig. 775. seq.)

(C.) UNIVALVE, Shells with regular turns.

CONCHÆ. (*Mollusca testacea cephalopoda et gasteropoda*.)

The direction of the turns of the Shells is almost universally the same; viz., so that when the point is turned downwards, and the opening upwards, the latter is turned to the left, and the turns are to the right from above downwards, corresponding to the apparent course of the sun. Some few Species have naturally their turns in the opposite direction; (*Abbild. Nat. Hist. Gegenst.* Tab. 20.) and occasionally, though rarely, monstrosities are found turning to the left in those Shells which commonly turn to the right, (anfractis sinistris sive contra-

riis.)* Some Snails are enabled to close their Shells by a peculiar covering, and others, on the approach of Winter, deposit a calcareous screen before the orifice.

47. ARGONAUTA. Testa univalvis spiralis, involuta, membranacea, unilocularis.

1. *Argo*. (Nautilus papyraceus.) The Paper-Sailor.—A. carina subdentata. (Animal sepia?)

(MARTINI. Vol. I. Tab. 17. fig. 156. seq.)

A milk-white, light, and very delicate Shell, of considerable size, supposed to be inhabited by an animal like the Cuttle-fish. The latter can sail on the surface of the Ocean by means of an expansible membrane, and can also sink at pleasure.

48. NAUTILUS. Testa univalvis, isthmis perforatis concamerata, polythalamia.

The Shells are divided into chambers, in the anterior of which the animal lives, and can make itself heavier or lighter at pleasure, by pumping water into or out of the others.

1. *Pompilius*. The Sailor. *Ger.* das Schiffboth. *Fr.* le Burgau.—N. testa spirali apertura cordata, anfractibus contiguis obtusis lævibus.

(MARTINI. Vol. I. Tab. 18.)

2. *Calcar*. N. testa spirali, apertura lineari, anfractibus contiguis: geniculis elevatis.

(MARTINI. Vol. I. Tab. 19. fig. 168. seq.)

One of the very small Shells of the sand of Rimini.

49. CONUS. *Ger.* Tute.—Testa univalvis, convoluta, turbinata. Apertura effusa longitudinalis, linearis, edentula, basi integra. Columella lævis.

1. *Marmoreus*. C. testa conica fusca, maculis ovatis albis, spiræ anfractibus canaliculatis.

(MARTINI. Vol. II. Tab. 62. fig. 685-88.)

2. *Ammiralis summus*. C. testa ferruginea maculis albis squamatis sparsis; fasciisque tribus flavis tenuissime reticulatis; media cingulo ferrugineo itidem squamulis albis interrupto.

(MARTINI. Vol. II. Tab. 57. fig. 634.)

In the East Indies.

3. *Locumtenens*. C. testa ferruginea maculis albis squamatis tota reticulata.

* See CHEMNITZ, *Conchylien-Cabinet*. B. ix. Absch. 1. *Von den Linksnecken*.

Particularly abundant in the Red Sea:

4. *Aurisiacus*. C. testa pallide aurantia, fasciis fuscis catenulatis : lineisque punctatis.

(MARTINI. Vol. II. Tab. 57. fig. 636.)

5. *Textile*. C. testa venis reticulatis luteis, maculis luteis fuscisque.

(MARTINI. Vol. II. Tab. 54. fig. 598. seq.)

50. *CYPRAEA*. (Concha veneris, sive cytheriaca, sive paphia.) Testa univalvis, involuta, subovata, obtusa, lævis. Apertura utrinque effusa, linearis, utrinque dentata, longitudinalis.

The animals of this Genus at certain periods cast off their Shells and obtain new ones ; which in many of the Species are so unlike the former, as to have given rise to numerous errors.

1. *Arabica*. C. testa subturbinata characteribus inscripta, macula longitudinali simplici.

(MARTINI. Vol. I. Tab. 31. fig. 328. seq.)

2. *Mauritiana*. C. testa obtusa triquetro-gibba postice depressa, acuta ; subtus nigra.

(MARTINI. Vol. I. Tab. 30. fig. 317. seq.)

3. *Tigris*. The Leopard-cowry Shell.—C. testa obtusa ovata, postice obtusa, antice rotundata, linea longitudinali testacea.

(MARTINI. Vol. I. Tab. 24. fig. 232. seq.)

In the East and West Indies, and also the South Seas. At Otaheite, it is used as a drinking vessel.

4. *Moneta*. The Cowry.—C. testa marginato-nodosa albida. Principally in the Philippine and Maldivé Islands, but also on the Coast of Guinea, and many Islands of the South Seas. They form, as is well known, the current coin of many Indian nations *, as well as of the Negroes of a great part of Africa and the West Indies. The Bramins use them as counters.

51. *BULLA*. Dipper. *Ger. Blasenschnecke*.—Testa univalvis, convoluta, inermis. Apertura subcoarctata, oblonga, longitudinalis, basi integerrima. Columella obliqua, lævis.

1. *Ovum*. B. testa ovata obtuse subbirostri, labro dentato.

* In Bengal 2,500 are worth about half a florin, and yet there are articles in the markets to be bought for a single cowry, such as Betel-leaves, Areca-nuts, &c.—See RENNELL'S *Geographical Illustrations of M. PARK'S Journey*. p. 86.

(MARTINI. Vol. I. Tab. 22. fig. 205. seq.)

2. *Physis*. B. testa rotundata glaberrima pellucida lineis crispata, spira retusa.

(MARTINI. Vol. I. Tab. 21. fig. 196.)

3. *Ficus*. B. testa obovata-clavata, reticulato-striata, cauda exserta, spira oblitterata.

(MARTINI. Vol. III. Tab. 66. fig. 733. seq.)

In both Indies.

52. *VOLUTA*. Rhomb-shell. *Ger.* Walze.—Testa unilocularis, spiralis. Apertura ecaudata subeffusa. Columella plicata; labio umbilicove nullo.

1. *Auris Midæ*. V. testa coarctata, ovali-oblonga, spira rugosa columella bidentata.

(MARTINI. Vol. II. Tab. 43. fig. 436. seq.)

2. *Oliva*. V. testa emarginata cylindroide lævi, spiræ basi reflexa, columella oblique striata.

(MARTINI. Vol. II. Tab. 45. fig. 472. seq.)

n the East Indies, North America, &c.

3. *Mitra*. V. testa marginata fusiformi lævi, labro denticulato, columella quadriplicata.

(MARTINI. Vol. IV. Tab. 147. fig. 1360.)

4. *Musica*. V. testa marginata fusiformi, anfractibus spinis obtusis, columella octoplicata, labro lævi crassiusculo.

(MARTINI. Vol. III. Tab. 96. fig. 926. seq.)

5. *Pirum*. V. testa obovata subcaudata: spiræ anfractibus striatis: apice producto glaberrimo, columella triplicata.

(MARTINI. Vol. III. Tab. 95. fig. 916-17.—And in CHEMNITZ.

Vol. IX. p. 1. Tab. 104. fig. 884. seq. *turning to the left.*)

Particularly on the Coast of Coromandel. It is made into arm and finger rings, worn by the poorer Hindoos; after their death, these rings are thrown by their relations into some holy river, and never again taken up by any of the people. Hence the great consumption of such rings, and the importance of the fishery for the Shells from which they are manufactured.

6. *Vexillum*. V. testa ventricosa flavicante aurantio striata; anfractu primo reliquis triplo majore tuberculato.

(CHEMNITZ. Vol. X. Vign. 20. A. B.)

In the Indian Ocean. A Shell, the value of which has been much enhanced by the cupidity of collectors.

53. *BUCCINUM*. Whelk. *Ger.* Sturmhaube.—Testa univalvis, spiralis, gibbosa. Apertura ovata, desinens in

canaliculum dextrum, cauda retusum. Labium interius explanatum.

The eggs of many Species are called Sea-Grapes, of others Sea-Hops, whilst in others they form a long row of horny, flat capsules, which lie close to one another, fastened by one edge to a rib a foot long.

1. *Harpa*. B. testa varicibus æqualibus longitudinalibus distinctis mucronatis, columella lævigata.

(MARTINI. Vol. III. Tab. 119. fig. 1090.)

2. *Lapillus*. B. testa ovata acuta striata lævi, columella planiuscula.

(MARTINI. Vol. III. Tab. 121. fig. 1111. seq.)

The animal gives a purple dye, which is used by the Norwegians.

3. *Undatum*. B. testa oblonga rudi transversim striata: anfractibus curvato-multangulis.

(MARTINI. Vol. IV. Tab. 126. fig. 1206. seq.)

4. *Maculatum*. B. testa turrita subfusiformi, anfractibus lævibus indivisis integerrimis.

(MARTINI. Vol. IV. Tab. 153. fig. 1440.)

54. *STROMBUS*. Screw. Ger. Flügelschnecke. — Testa univalvis, spiralis, latere ampliata. Apertura labro sæpius dilatato, desirens in canalem sinistrum.

1. *Fusus*. S. testa turrita lævi, cauda subulata, labio dentato.

(MARTINI. Vol. IV. Tab. 158. fig. 1493. seq.)

2. *Chiragra*. S. testa labro hexadactylo, digitis curvis, cauda recurvata.

(MARTINI. Vol. III. Tab. 86. seq. fig. 853. seq.)

3. *Lentiginosus*. S. testæ labro antice trilobo incrassato, dorso verrucoso coronato, cauda obtusa.

(MARTINI. Vol. III. Tab. 78. fig. 800.)

The operculum of this and some similar Shells was formerly official, under the name of *Unguis odoratus*; or *Blatta byzantina*.

55. *MUREX*. Rock-shell. Ger. Stachelschnecke. — Testa univalvis, spiralis, exasperata suturis membranaceis. Apertura desinens in canalem integrum, rectum sive subascendentem.

1. *Tribulus*. M. testa ovata spinis setaceis trifariis, cauda elongata subulata recta, similiter spinosa.

(MARTINI. Vol. III. Tab. 113. fig. 1055. seq.)

2. *Brandaris*. M. testa subovata spinis rectis cincta, cauda mediocri subulata recta spinisque oblique circumdata.

(MARTINI. Vol. III. Tab. 114. fig. 1058. seq.)

In the Mediterranean ; as is also the following Species.

3. *Trunculus*. M. testa ovata nodosa antierius spinis cincta, cauda brevior truncata perforata.

(LISTER. Tab. 947. fig. 42.)

Together with the above, one of the Purple-shells of the ancients*.

4. *Antiquus*. M. testa patulo-caudata oblonga, anfractibus 8 teretibus.

(MARTINI. Vol. IV. Tab. 138. fig. 1292. seq.)

On the Coasts of Great Britain, Iceland, &c.

5. *Vertagus*. M. testa turrita, anfractibus superne plicatis, cauda adscendente, columella intus plicata.

(MARTINI. Vol. IV. Tab. 156. seq. fig. 1479. seq.)

56. *TROCHUS*. Top-shell. Button-shell. *Ger.* Kräusel-schnecke.—Testa univalvis, spiralis, subconica. Apertura subtetragono-angulata sive rotundata, superius transversa, coarctata : columella obliquata.

1. *Perspectivus*. The Staircase. *Ger.* die Perspectivschnecke.—T. testa convexa obtusa marginata, umbilico pervio crenulato.

(CHEMNITZ. Vol. V. Tab. 172. p. 1691. seq.)

A remarkable shell with very delicate windings, leaving a funnel-shaped cavity in the middle†.

2. *Magus*. T. testa oblique umbilicata convexa : anfractibus supra obtuse nodulosus.

(CHEMNITZ. Vol. V. Tab. 171. fig. 1656. seq.)

3. *Telescopium*. T. testa imperforata turrita striata, columella exserta spirali.

(CHEMNITZ. Vol. V. Tab. 160. fig. 1507. seq.)

4. *Iridis*. The Beauty. *Fr.* la Cantharide.—T. testa imperforata ovata, subcærulea, lævi, oblique striata.

(MARTYN'S *South Sea Shells*, Tab. 21. (24.) m.)

When the bluish layer covering this beautiful New Zealand

* See MICH. ROSA, *Delle porpore degli Antichi*. Moden. 1786. 4to.—With plates.

† LINNÆUS calls this cavity or umbilicus “*stupendum naturæ artificium*,” and modern archæologists consider the shell as the prototype of the volute of the Ionic column.

Shell is removed, it displays most splendid gold and green colours.

6. *Lithophorus*. T. testa imperforata rugosa, quisquiliarum impressionibus scabra.

(CHEMNITZ. Vol. V. Tab. 172. fig. 1688. seq.)

In the West Indian Islands. It has its name from the irregularities, like blows from a hammer, or small-pox marks, caused by the little pebbles, and fragments of other shells attached to it.

57. *TURBO*. Whirl-wreath. *Ger.* Mondschncke.—Testa univalvis, spiralis, solida. Apertura coarctata, orbiculata, integra.

1. *Littoreus*. T. testa subovata acuta striata, margine columnari plano.

(CHEMNITZ. Vol. V. Tab. 185. fig. 1852.)

In many Seas : among others the Adriatic, the nations near it eating the animal in great numbers.

2. *Cochlus*. T. testa imperforata ovata striata ; stria unica dorsali crassiore.

(CHEMNITZ. Vol. V. Tab. 172. fig. 1805. seq.)

The operculum of this and some similar Species forms the *umbilicus veneris*.

3. *Scalaris*. (Scalata.) T. testa cancellata conica *anfractibus distantibus*.

(MARTINI. Vol. IV. Tab. 152. fig. 1426. seq.)

Principally on the Coast of Coromandel. It is distinguished by its turns being distant, and apparently interrupted.

4. *Clathrus*. T. testa cancellata turrita exumbilicata, *anfractibus contiguis lævibus*.

(MARTINI. Vol. IV. Tab. 152. fig. 1434. seq.)

5. *Terebra*. T. testa turrita : *anfractibus carinis 6 acutis*.

(*Frontispiece to MARTYN'S South Sea Shells.*)

6. *Perversus*. T. testa turrita pellucida : *anfractibus contrariis, apertura edentula*.

(CHEMNITZ. Vol. IX. Tab. 112. fig. 959.)

This little Shell, which turns to the left, is, with this exception, very similar to the *Turbo muscorum*, and is very common on the stems of old willows and other trees.

7. *Nautileus*. T. testa planiuscula *anfractibus annulatis, dorso cristatis*.

(RÖSEL. *Polypen-Historie*. Tab. 97. fig. 7.)

In fresh water.

58. *HELIX*. Snail. Periwinkle. *Ger.* Schnirkelschnecke.
Fr. Escargot.—Testa univalvis, spiralis, subdiaphana, fragilis. Apertura coarctata, intus lunata sive subrotunda : segmento circuli demto.

Mostly land and fresh water animals.

1. *Hispida*. H. testa umbilicata convexa hispida diaphana, anfractibus quinis, apertura subrotundo-lunata.
2. *Pomatia*. H. testa umbilicata subovata, obtusa decolore, apertura subrotundo-lunata.

(CHEMNITZ. Vol. IX. Tab. 128. fig. 1138.)

In many places, particularly Switzerland, a considerable trade is carried on in these Snails, about the period of Lent. In the same country there are also gardens, in which they are fed in many thousands together. Their great reproductive powers have been already alluded to.

3. *Arbustorum*. H. testa umbilicata convexa acuminata, apertura suborbiculari bimarginata, antice elongata.

(CHEMNITZ. Vol. IX. Tab. 133. fig. 1102.)

4. *Ianthina*. H. testa subimperfiorata subrotunda obtusa diaphana fragilissima, apertura postice dilatata, labro emarginato.

(FAB. COLUMNA. p. 22.)

In the Mediterranean, Atlantic, and South Sea. The animal, like many others of the same kind, affords a purple fluid. The shell is of a purplish blue colour.

5. *Vivipara*. H. imperfiorata subovata obtusa cornea : cingulis fuscatis ; apertura suborbiculari.

(FRISCH. *Insecten*. p. 13. Tab. 1.)

6. *Nemoralis*. H. testa imperfiorata subrotunda lævi diaphana fasciata, apertura subrotundo-lunata.

(CHEMNITZ. Vol. IX. Tab. 133. fig. 1196. seq.)

7. *Decollata*. H. testa imperfiorata turrata ; spira mutilato-truncata, apertura ovata.

(CHEMNITZ. Vol. IX. Tab. 136. fig. 1254. seq.)

8. *Halioidea*. H. testa imperfiorata depresso-planiuscula striis undatis ; apertura ovali dilatata usque in apicem.

(MARTINI. Vol. I. Tab. 16. fig. 151. seq.)

59. *MERITA*. Testa univalvis, spiralis, gibba, subtus planiuscula. Apertura semiorbicularis : labio columellæ transverso, truncato, planiusculo.

1. *Canrena*. N. testa umbilicata lævi, spira submucronata, umbilico gibbo bifido.

(CHEMNITZ. Vol. V. Tab. 186. fig. 1860. seq.)

2. *Fluviatilis*. N. testa purpurescence, maculis albis tessellata. A very delicately marked animal, which, as well as the next Species, carries its young about on its shell*.

3. *Pulligera*. N. testa lævi rudi, spirula excavato-oculata, labio interiore lævi crenulato.

A fresh water Shell, from the East Indies.

60. *HALIOTIS*. Sea-ear. Venus's ear. Ger. Seeohr.—Testa auriformis patens: spira occultata laterali; disco longitudinaliter poris pertuso.

1. *Tuberculata*. H. testa subovata dorso transversim rugoso tuberculato.

(MARTINI. Vol. I. Tab. 15. seq. fig. 145. seq.)

2. *Iris*. (*Hipaiia*.) H. testa ovata, dorso gibbo, spira alte prominula.

(MARTYN's *South Sea Shells*. Tab. 61. a. a.)

This glittering and indescribably splendid Shell is found among our antipodes at New Zealand.

(D.) UNIVALVE, Shells without any regular convolutions.

Found in water only; and by far most frequently in the Ocean.

61. *PATELLA*. Limpet. Ger. Napfschnecke.—Testa univalvis subconica absque spira externa.

1. *Neritoidea*. P. testa integra ovata apice subspirali, labio laterali.

2. *Vulgata*. P. testa subangulata: angulis 14 obsoletis; margine dilatato acuto.

(MARTINI. Vol. I. Tab. 5. fig. 38.)

3. *Lacustris*. P. testa integerrima ovali, vertice mucronato reflexo.

4. *Fissura*. P. testa ovali striato-reticulata, vertice recurvo antice fissa.

(MARTINI. Vol. I. Tab. 12. fig. 109.)

5. *Græca*. P. testa ovata convexa: margine introrsum crenulato, vertice perforato.

(TOURNEFORT. *Voy. du Levant*. Vol. I. p. 294.)

A common article of food in the Islands of the Archipelago.

62. *DENTALIUM*. Tooth-Shell. Ger. Meerzahn.—Testa univalvis, tubulosa, recta, utraque extremitate pervia.

* RAPFOLT, in *Commerc. Nor.* 1738. p. 177. seq.

1. *Entalis*. D. testa tereti subarcuata continua lævi.

(MARTINI. Vol. I. Tab. 1. fig. 1. seq.)

2. *Minutum*. D. testa tereti erectiuscula lævi minuta.

Found in the sand at Rimini.

63. SERPULA. Worm-shell. Ger. Wurmröhre.—Testa univalvis, tubulosa, adhærens.

1. *Filigrana*. S. testis capillaribus fasciculatis ramoso-glomeratis cancellatisque.

(SEBA. Vol. III. Tab. 100. fig. 8.)

2. *Contortuplicata*. S. testa semitereti rugosa glomerata carinata.

(Abbild. Nat. Hist. Gegenst. Tab. 59.)

This little animal, which I have had an opportunity of examining, has a very pleasing form; having seven long arms converging, bent into an arch, and beset with sixty short, straight fibres at the root.

3. *Perforata*. The Watering-pot.—S. testa tereti recta, extremitatibus disco poris pertuso, margine reflexo, tubuloso.

(Museum Leersianum. Tab. 1.)

A singular Species, which has considerable resemblance to the tube-coral. The orifice is like the end of a watering-pot, and its edge is surrounded with a ring of little tubes. The posterior extremity is almost always broken off.

4. *Gigantea*. Testa subflexuosa lente attenuata violacea, intus lævi lutea: apertura alba undulatim striata dente conico munita.

(Abbild. Nat. Hist. Gegenst. Tab. 9.)

In the West Indies. The animal resembles the stone-borer. (*Mytilus lithophagus*.) It inhabits excavated passages in large Madrepores.

64. TEREDO. Testa teres, flexuosa, lignum penetrans.

1. *Navalis*. T. corpore tereti elongato, ore attenuato, extremitate postica pholadiforma, quadrivalvi.

(Abbild. Nat. Hist. Gegenst. Tab. 89.)

This destructive animal is about a foot long. It attacks oak, alder, fir, and other timber, boring passages as wide as a finger, which it lines with a calcareous layer. It has threatened great danger in Holland, particularly in 1730, by perforating the dams of Zealand and Friezland, in such a manner as to render them incapable of supporting the force of the waves: even

at present, it causes great devastations, particularly in the dyke of Westkappler.

IV. CRUSTACEA.

I have arranged these animals in a particular Order, as they differ in many respects from Worms, and have many common characters. They live only in the sea; and in general no animals of the three remaining Orders live out of water.

65. *ECHINUS* *. Sea-hedgehog. *Ger.* See-Igel. *Fr.* Oursin.
—Corpus subrotundum, crusta spatacea tectum, spinis mobilibus sæpius aculeatum. Os quinquevalve subtus.

The Shell of the Sea-hedgehog (which in texture resembles that of the Crab,) is provided with moveable prickles, which, however, must not be confounded with the actual organs of motion. The latter are about a third longer than the prickles, and visible only whilst the animal is under water, being retracted when it is taken out of its element. A Sea-hedgehog, which has perhaps 2000 prickles, has about 1400 such organs of motion. Those Echini which are convex, have within a remarkable bony frame, known by the singular name of Aristotle's lantern. The very numerous Species of this extensive Genus vary considerably, as well in the form of the Shell as of the prickles.

1. *Esculentus*. The Sea-egg.—*E. hemisphærico-globosus*; areis obsolete verrucosis.

(KLEIN. Tab. 1. et 38. fig. 1.)

2. *Cidaris*. *E. hemisphærico-depressus*: ambulacris 5 repandis linearibus; areis alternatim bifariis.

(KLEIN. Tab. 7. A. et 39. fig. 2.)

3. *Orbiculus*. *E. planus suborbiculatus*; ambulacris 5 ovalibus, ano subremoto.

(KLEIN. Tab. 21. seq.)

66. *ASTERIAS* †. Sea Star.—Corpus depressum, crusta subcoriacea, tentaculis muricata. Os centrale, quinquevalve.

The organs of motion are similar to those of the Echini. They move, however, much more slowly, like Snails. Many of the Species are noxious to Oysters, others to Cod-fish, &c.

* J. T. KLEINII, *naturalis dispositio echinodermatum* ex ed. N. G. LESKE, Lips. 1778. 4to.

† J. H. LINKIUS, *de stellis marinis*. Lips. 1733. fol.

1. *Rubens*. *A. stellata*, radiis lanceolatis gibbis, undique aculeata.

(LINK. Tab. 4. fig. 5, &c.)

In this Species the power of reproduction is particularly striking. In a series of this Species, in progress of reproduction, I possess one in which regeneration had begun of the four rays that had been removed, out of five which it originally possessed.

2. *Glacialis*. *A. stellata*, radiis angulatis, angulis verrucoso-aculeatis.

(LINK. Tab. 38, 39.)

3. *Ophiura*. *A. radiata* radiis 5 simplicibus, stella orbiculata quinqueloba.

(LINK. Tab. 37. fig. 65, &c.)

4. *Caput Medusæ*. (Gorgono-cephalus.) *A. radiata*, radiis dichotomis.

(LINK. Tab. 18. fig. 28, &c.)

In many Seas of the Old World, and also in the Caspian. That of the Northern Ocean, however, appears to differ specifically from that of the Southern Indian Seas. A very inactive and singularly formed animal, on the circumference of which 82,000 extremities have been reckoned.

There is a popular idea among the Norwegians, that this animal is the young of the famous Kraken, of which PONTOPPIDAN has related so many wonders in his Natural History of Norway. This monster is supposed to live in the depths of the sea, rising occasionally to the great danger of the ships with which it comes in contact, at which times the projection of its back above the surface of the sea, resembles a floating island.

When all that has been said about it is carefully examined, it is clear that various circumstances have given rise to the misconception. Much of it is applicable to the whale; (see for instance the narrative of an accident from the rising of such an animal, in W. TENCH's *Account of the Settlement at Port Jackson*;) much is referable to thick, low, fog-banks, which even experienced seamen have mistaken for land; (see a remarkable instance in *Voyage de LA PÉROUSE autour du Monde*. Vol. III. p. 10.) an opinion coinciding with what was long since said of this same Kraken by old THORMOD TORFESSEN in his *Groenlandia antiqua*, p. 100:—"Tracta hæc fabula videtur ex insula aliquando conspicua, sæpius tamen inconspicua."

67. ENCRINUS, Stirps elongata, corpore terminali radiato.

1. *Asteria*. (Isis *asteria*. LINN.) E. stirpe spatacea articulata pentagona, ramis verticillatis: stella terminali sexfida ad basin, tum dichotoma.

(GUETTARD. *Mem. de l'Ac. des Sc.* 1755.)

This rare animal has hitherto been found on the Coasts of Barbadoes only: it resembles the fossil Pentacrinites or Medusa-Palms, without, however, being specifically similar. The head, as it is called, has considerable resemblance to the Caput Medusæ just mentioned.

2. *Radiatus*. (Vorticella *encrinus*. LINN.) E. stirpe cartilaginea continua, stella terminali octoradiata.

(C. MYLIUS, *Schreiben an Haller*. Lond. 1755. 4to.)

V. CORALLIA.

This Order bears nearly the same relation to the following one that the Testacea do to the Mollusca. Even the animals, at least in many of the Genera of the two Orders, coincide in several particulars. In the one, however, they are uncovered, and have the power of locomotion; in the other, they inhabit certain immovable dwellings, which in most cases are of a stony consistence, and are called Corals. These last, however, are not to be considered in the light of habitations constructed by the animals, but rather as inseparable and congenital parts of their structure, not as analogous to the cells of Bees, but rather to the shells of Snails: in their propagation, however, the young animal is produced together with its calcareous dwelling, in the same manner that a twig is shot out from a tree. Hence, too, the speedy increase and growth of these singular animals, will serve to explain their immense size and extent*.

* On the History of Corals, see P. S. PALLAS, *Elenchus Zoophytorum*. Hag. 1766. 8vo.—In German, with Additions, by C. F. WILKENS. Nürnberg. 1787. 4to.

J. ELLIS, *Natural History of the Corallines*, &c. London, 1753. 4to. In German, with Additions, by J. G. KRUNITZ. Nürnberg. 1767. 4to.

EJ. *Natural History of many curious and uncommon Zoophytes systematically arranged and described* by D. SOLANDER, London, 1786. 4to. p. 449.

(I quote this excellent work by the name of SOLANDER, to distinguish it from the preceding.)

VITAL. DONATI, *Della Storia Naturelle marina dell' Adriatico*. Ven. 1750. 4to. F. CAVOLINI, &c.

Remark. I know from eye-witnesses, that pieces of wreck are often found in the West Indies to be overgrown with Madrepores and other Corals, within three quarters of a year. From the same cause, the Harbour of Bantam, formerly so excellent, is now almost wholly obstructed.

Many volcanic Islands of the South Seas and West Indies, Barbadoes for instance, are, as it were, invested with a circle of Coral. Captain Cook, in his first voyage round the World, had ample experience on the East Coast of New Holland, which he first explored, of the danger to navigators of unknown shores, caused by the projection of Coral stems to a vast height from the bottom of the Sea.

68. TUBIPORA. *Corallium tubis cylindricis, cavis, erectis, pallelis.*

1. *Musica*. T. tubis fasciculatis combinatis: dissepimentis transversis distantibus.

(SOLANDER. Tab. 27.)

In the East and South Indies only.

69. MADREPORA. *Corallium cavitatibus lamelloso-stellatis.*

1. *Fungites*. M. simplex acaulis orbiculata, stella convexa: lamellis simplicibus longitudinalibus, subtus concava.

(SOLANDER. Tab. 28.)

2. *Muricata*. M. ramoso-composita subimbricata, stellis oblique truncatis prominentibus adscendentibus.

(SOLANDER. Tab. 57.)

3. *Oculata*. M. caulescens tubuloso-glabra flexuosa oblique substriata, ramis alternis, stellis immersis bifariis.

(SEBA. Vol. III. Tab. 116. fig. 1, 2.)

70. MILLEPORA. *Corallium poris turbinatis teretibus.*

1. *Lichenoides*. M. caulescens decumbens bifarie dichotoma, ramis denticulatis binis porosis scabris.

(ELLIS. Tab. 35. fig. b. B.)

2. *Cellulosa*. M. membranacea reticulata umbilicata, turbinato-undulata, hinc porosa pubescens.

(ELLIS. Tab. 24. fig. d.—CAVOLINI. Tab. 3. fig. 12. seq.)

F. CAVOLINI, *Memoria per servire alla storia dei polipi marini*. Nass. 1785. 4to.—In German by W. SPRENGEL. Nürnberg. 1813. 4to.

E. J. C. ESPERS, *Pflanzenhiere*, &c. Nürnberg. 1788. seq. 4to.

J. E. ROQUES DE MAUMONT, *sur les Polypiers de Mer*. Zelle. 1782. 8vo.

J. A. H. REIMARUS, *von der Natur der Pflanzenhiere*, (as an Appendix to S. REIMARUS' *Considerations on the various kinds of Animal Instincts*.) Hamburg, 1773. 8vo.

71. **CELLEPORA.** *Corallium foraminulis urceolatis, membranaceis.*

1. *Spongites.* (Adarce.—*Lapis spongiæ offic.*) *C. lamellis simplicibus undulato-turbinatis cumulatis; cellulis seriatis; osculo marginato.*

72. **ISIS.** *Stirps radicata solida, cortice molli habitabili obducta*.*

1. *Hippuris.* *I. stirpe articulata, geniculis attenuatis.*
(*SOLANDER. Tab. 3. fig. 1. Tab. 9. fig. 3, 4.*)
2. *Nobilis.* *I. stirpe continua, æquali, striis obsoletis obliquis ramis vagis.*

(*CAVOLINI. Tab. 2. fig. 1-6.*)

Is collected principally from the shores of the Mediterranean, and manufactured at Marseilles, &c., into various works of art; which in the East Indies, and especially China and Japan, are held in nearly equal estimation with precious stones.

73. **GORGONIA.** *Crusta calcarea corallina stirpem vegetabilem obducens.*

The stems appear to be really vegetables (the woody nature of which in the larger ones cannot be mistaken) incrustated with Corals. The *Gorgonia flabellum* is often found without this covering, and it then certainly shews no signs of animality †.

1. *Antipathes.* *G. paniculato-ramosa ligno extus flexuose striato.*

(*SEBA Thesaur. 3. Tab. 104. fig. 2.*)

2. *Flabellum.* *G. reticulata, ramis interne compressis, cortice flavo.*

(*ELLIS. Tab. 26. fig. k.*)

74. **ALCYONIUM.** *Stirps radicata, stuposa, tunicato-corticata. Animal hydra.*

1. *Exos.* (*Manus marina.*) *A. stirpe arborescente coriacea coccinea superne ramosa; papillis stellatis.*

(*GESNER. de aquatil. p. 619.*)

2. *Epipetrum.* *A. stirpe cavata carnosus rufescente.*

(*GESNER. l. c.*)

75. **SPONGIA.** *Stirps radicata flexilis, spongiosa, bibula.*

I think it every day more doubtful that this Genus really belongs to the animal kingdom.

* On this, and the following Genera of Corals, see J. V. F. LAMOUROUX, *Histoire des Polypiers coralligènes flexibles.* Caen. 1816. 8vo. with plates.

† See ELLIS' reasons for a contrary opinion in the *Phil. Trans.* Vol. 66. P. I. p. 1.

1. *Officinalis*. *S. foraminulata subramosa difformis tenax tomentosa*.
2. *Fluviatilis*. (Russ. Badiäga.) *S. conformis polymorpha, fragilis granulis repleta*.

This Species diffuses a peculiar strong smell, and is often interwoven, but only accidentally, with stems of the plumed Polype. When it is young it lies flat on banks, dykes, &c.: but in time shoots out branches like fingers or antlers. When dry, it is brittle and friable. I have found it in the foss of this place (Göttingen,) and have experimented upon it in many ways without being able to discover any decisive evidence of its animal nature.

76. FLUSTRA. *Stirpis radicata foliacea, undique poris cellulosis tecta*.

1. *Foliacea*. *F. foliacea ramosa, laciniis cuneiformibus rotundatis*.

(ELLIS. Tab. 29. fig. a.)

77. TUBULARIA. *Stirps radiata, filiformis, tubulosa*.

This Genus includes, among others, the fresh-water Corals, viz. the plume-Polypes (*Ger. Federbusch Polypen. Fr. les Polypes à panache*.) in which the crust must be distinguished from the little animal inhabiting it, and whose principal character consists in a very delicate little plume which it retracts on the least disturbance, and when dying. The crust is originally gelatinous, but gradually hardens and presents very different forms, even in the same Species. Some such tubes I have seen projecting from aquatic plants; others, which shot out twigs like little trees in the interstices of the *Spongia fluviatilis*; others lying flat near one another on dykes, &c.; others heaped together in vast numbers, forming large masses.

1. *Indivisa*. *T. culmis simplicissimis, geniculis contortis*.

(ELLIS. Tab. 16. fig. c.)

2. *Acetabulum*. *T. culmis filiformibus, pelta terminali striata radiata calcarea*.

(DONATI. Tab. 2.)

3. *Campanulata*. *T. crista lunata, orificiis vaginæ annulatis, corpore intra vaginam abscondito*.

(RÜSEL. *Hist. der Polypen*. Tab. 73-75.)

Together with the next Species in fresh-water. It has about sixty arms or fibres in its plume.

4. *Sultana*. *T. crista infundibuliformi, ad basin ciliata*.

A very delicate little animal, which I have found in the foss of this place. It has twenty arms, which are arranged very regularly in a little plume*.

78. CORALLINA. Stirps radicata, geniculata, filamentosa, calcarea.

1. *Opuntia*. C. trichotoma : articulis compressis subreniformibus.

(SOLANDER. Tab. 20. fig. b.)

2. *Officinalis*. C. subbipinnata, articulis subturbinatis.

(ELLIS. Tab. 24. fig. b.)

3. *Rubens*. C. dichotoma capillaris fastigiata : articulis superioribus elevatis.

(ELLIS. Tab. 24. fig. f. g.)

79. SERTULARIA. Stirps radicata, tubulosa, cornea, nuda, articulata : dentibus calyciformibus obsita.

An extensive Genus, many Species of which are found on the convex shell of the common Oyster. The stems are generally very delicate, and the whole of their beauty scarcely discernible by the naked eye. They increase by means of bladders, which may be compared to ovaria.

1. *Abietina*. S. denticulis suboppositis tubulosis, ovariis ovalibus, ramis pinnato-alternis.

(ELLIS. Tab. 1. fig. b.)

2. *Falcata*. S. denticulis secundis imbricatis truncatis, ovariis ovatis, ramis pennatis alternis.

(ELLIS. Tab. 7. fig. a.)

3. *Polyzonias*. S. denticulis alternis subdenticulatis, ovariis ovatis polyzoniis, stirpe ramosa.

(ELLIS. Tab. 3. fig. a.)

The difference of size excepted, TREMBLEY found these Sertulariæ very similar to his Arm-polypes of fresh-water.

80. CELLULARIA. Stirps crustacea lapidescens, e cellulis seriatis composita ; plerumque ramosa et articulata, tubulis adhærens.

1. *Fastigiata*. (Sertularia fastigiata. LINN.) C. denticulis alternis acutis, ramis dichotomis erectis fastigiatis.

(ELLIS. Tab. 18. fig. a.)

2. *Cirrata*. C. lapidea articulata ramosa dichotoma, articulis subciliatis, ovato-truncatis, uno latere planis celliferis.

(SOLANDER. Tab. 4. fig. d.)

* Götting. Magazin. 1. J. 4 St.—S. 117, &c.

VI. ZOOPHYTA.

The term Zoophyte has been indiscriminately applied to the animals of this and the last Order; and in fact, as has been already mentioned, many Polypes in this resemble the inhabitants of the Corals, differing in being uncovered, and without coralline habitations. Besides, most, if not all of them, are capable of changing their position; (with a—*stirps libera*—as it is expressed.) Some are connected together on a common stem; others are single. The infusory animalculæ, and some similar creatures, are also included in this Order.

81. PENNATULA. *Stirps libera, penniformis.*

In these remarkable marine animals there are, as in the feathers of birds, two principal parts, the quill and the vane. The latter consists of forty, sixty, or more, curved arms or fibres, attached to both sides of the upper half of the quill. On each of these arms stand ten, twelve, or more, small and very delicate shells, denticulated at the edge, in each of which is a little gelatinous Polype with eight arms; so that at least 500 such Polypes may be reckoned on a single Sea-feather. (Pennatula.)

1. *Grisea*. P. stirpe carnosa, rachi lævi, pinnis imbricatis plicatis spinosis.

(B. S. ALBINI. *Annot. Acad. L.* 1. Tab. 4. fig. 1, 2.)

2. *Phosphorea*. P. stirpe carnosa, rachi scabra, pinnis imbricatis.

(*Abbild. Nat. Hist. Gegenst.* Tab. 90.)

Shines vividly in the dark.

82. HYDRA. *Corpus gelatinosum conicum, os terminale cinctum cirris filiformibus.*

These celebrated animals* are gelatinous, semi-transparent, and therefore not easily detected by unpractised eyes. In a state of rest, the body and arms are extended; but when disturbed and taken out of the water, they contract into a shapeless mass. They are found in ponds and gently-running

* A. TREMBLEY, *Memoires pour servir à l'histoire d'un genre de Polypes d'eau douce à bras en forme de cornes.* Leid. 1744. 4to.

H. BAKER'S *Natural History of the Polype.* Lond. 1743. 8vo.

RÖSEL'S *Historie der Polypen*, &c. Nürnberg. 1754. 4to. (In the third Vol. of his *Insecten—Belustigungen.*)

J. C. SCHAFER'S *Armpolypen in den süßen Wassern um Regensburg.*—1754. 4to.

streams, from the commencement of the Spring until Autumn, attached by the posterior extremity to aquatic plants, shells, &c. Their whole body is in fact but a stomach provided with arms for taking their prey. They propagate during Summer, by shooting out living young ones like buds, which frequently detach others previous to their separation from the parent stem. On the approach of Winter, however, they have also the power of laying eggs *, whence a new progeny escapes in the ensuing Spring. When divided into six, or even more pieces, each piece is within a few days converted into a perfect Polype. By dividing the head or the posterior part of the body longitudinally, the number of those parts may be increased at pleasure. Several may be stuck together, and in this or other ways formed into singular and monstrous groups. They may be turned inside out like a glove; a manoeuvre, it is true, requiring considerable dexterity and practice. They may be divided longitudinally, and expanded like a piece of ribband, and in that state, as RÖSEL has remarked, they have the power of destroying each other in an incomprehensible manner, or rather of running together. According to the remarkable observations of the late Prof. LICHTENBERG, when included in a noose of hair, in proportion as the loop cuts its way through them, the divided parts are reunited †.

1. *Viridis*. *H. viridis tentaculis brevioribus*.

This Species appears to vary more than the others, with regard to the strength and length of the arms and body. It is found near this place, and the observations of its reproductive powers, first led to my investigations on the *Nisus formativus*,

2. *Fusca*. *H. fusca, corpore longiore, cirris longissimis*.

(RÖSEL. Tab. 84.)

3. *Grisea*. *H. aurantia, corpore longiore, cirris longioribus*.

(RÖSEL. Tab. 78.)

83. BRACHIONUS. Blossom-polype. *Ger. Blumenpolype*.

Fr. Polype à bouquet.—*Stirps ramosa, polypis terminalibus ore contractili (plerisque ciliato)*.

These Polypes are attached like branches to a common stem. Such a collection of them appears to the naked eye like a lump of mould, (*mucor*,) which, on the least agitation, contracts, and seems to vanish for a moment.

* PALLAS, *Elenchus Zoophytorum*. p. 28.

† Götting. Mag. J. 3. St. 4. S. 565, &c.

1. *Anastatica*. B. stirpe multifida, floribus campanulatis. These very delicate little animals propagate in the most simple manner, by division. (§ 20.)

2. *Umbellarius*. (*Vorticella umbellaria*. LINN.) B. stirpe umbellata, floribus ciliatis globosis muticis.

(RÖSEL. Tab. 100.)

Together with the preceding Species and the next Genus, in ponds and ditches, on aquatic plants, shells, &c.

84. VORTICELLA. Corpus nudum, simplex, vagum.

They live in societies of many thousands together, and have then almost the appearance of *mucor*. I have even seen the back of living Salamanders covered with vast numbers.

1. *Stentorea*. (*Hydra stentorea*. LINN.) V. corpore infundibuliformi, tentaculis ciliaribus.

(RÖSEL. Tab. 94. fig. 7, 8.)

2. *Socialis*. (*Hydra socialis*. LINN.) V. mutica torosa rugosa.

(RÖSEL. Tab. 95.)

85. FURCULARIA. Corpus liberum nudum oblongum, tentaculis rotatoriis ciliatis, cauda bicuspidata.

1. *Rotatoria*. The Wheel-animal. Ger. das Räderthier. Fr. le Rotifère.

This very singular microscopic animalcule exists in stagnant waters and various infusions. It swims very actively, and changes its form almost every moment. It is capable of reviving by the contact of a drop of water, after having lain in the dry state for a year, apparently dead; and this may be repeated ten or twelve times. The dark substance in the anterior part of its body, which, notwithstanding its voluntary motion, so many naturalists have considered as a heart, is not so, but, as I have convinced myself, an organ belonging to the alimentary canal*.

86. VIBRIO. Corpus liberum, teres, elongatum.

1. *Aceti*. V. subrigidus, cauda longiore tenuiore acuminata: mucrone retractili ad basin prominente.

(GOEZE in the *Naturforscher* 18. Tab. 3. fig. 12. &c.)

In vinegar. A similar Species in book-binder's old paste. These are Species of animals which should seem to have been formed long after the general Creation. As far as is known, they are found only in vinegar and paste, products of the ingenuity of man in a cultivated state.

* See my *Manual of Comparative Anatomy*. p. 245.

87. *Volvox*. Corpus liberum, rotundum, gelatinosum, gyratile. Tubus alimentarius vix ullus.

1. *Globator*. V. globosus, superficie granulata.

(RÖSEL. Tab. 101. fig. 1-3.)

A little ball, of yellow, green, or other colours, which, without having any evident organs of locomotion, moves and turns actively in water. When full grown, the progeny can be distinguished in its body, even to the fourth generation.

28. *Chaos*. Corpus liberum.———

(Generi polymorphon, speciebus uniforme.)

Following the plan of LINNÆUS, we conclude the general history of animals by including, under this generic term, the innumerable* creatures not visible by the naked eye, of which, many Species are found in sea and fresh water; others in the infusions of various animal and vegetable substances, (hence called Infusory Animalcules;) and others in the mature semen of male animals†.

They may be divided into three families, of which, each embraces numerous Species:—

(A.) Aquatile.

Those of sea, and stagnant fresh water, particularly such as the green matter of PRIESTLEY vegetates‡.

(B.) Infusorium.

The Infusory Animalcules, properly so called.

(C.) Spermaticum. (*Cercaria spermatica*.)

The Animalculæ found in semen. The late M. HOLLMANN has computed, that the Milt of a Carp, two pounds weight, contains upwards of 253,000 millions of Spermatic Animalcules.

* Even in the seventieth year of the last Century, O. F. MULLER was acquainted with 400 Species of Infusory Animalcules.

† See G. R. TREVIRANUS, *Biologie*. B. 2. S. 264., &c.—And C. L. NITZSCH, *Beytrag zur Infusorien-kunde*. Halle. 1817. 8vo. with plates.

‡ Which matter may be considered the lowest degree of vegetation, as the *Chaos aquatile*, present in it, is of actual animality.

SECT. X.

OF PLANTS.

§ 158. We come now to the second kingdom of living or organized bodies, Plants, which, according to the definitions already established, (§ 3 and 4.) differ from animals in this respect, that they absorb their homogeneous nutritive juice without any evident voluntary motion, and principally by means of the root, which is, therefore, by far the most universal of all their external parts, existing in nearly all, a few such as the Nostock, Truffles, &c., being the only exceptions.

§ 159. In addition, the form of plants in general, is different from that of most animals, inasmuch as their growth, and in particular the numbers of individual parts, branches, leaves, flowers, &c. are much less definite, and altogether infinitely more mutable. (*Extensio minus definita.*)

§ 160. On the contrary, their internal structure appears to be in an equal degree more uniform, exhibiting nothing which can be compared to the viscera, so essential to the economy of animals, and nothing similar to their nerves, muscles and bones: their organization is ultimately reducible to vessels, properly so called, and the cellular structure intervening between them*.

§ 161. The latter has a more perfect claim to the term *cellular* than the mucous tissue of animals to which it has been applied, since, in many parts of plants at least, it presents a real cellular disposition, sometimes including air, at others fluids. It is particularly evident in the bark and pith (medulla) of many plants, inclosing numerous large vesicles (utriculi,) and occasionally forming long tube-like cavities.

§ 162. The vessels, properly so called, which appear to be

* See on this subject, the two Göttingen Prize Essays; RUDOLPHI. Berlin, 1807. 8vo.—and LINK, Götting. 1807, with additions, 1809. 8vo.—Also L. C. T. TREVIRANUS, *vom inwendigen Bau der Gewächse*. Götting. 1806, which obtained the Accessit.—Of earlier works, see J. J. BERNHARDI, *Beobachtungen über die Pflancngefäße*. Erf. 1805. 8vo.

For an account of OSIANDER's successful attempts to inject plants with Mercury, see *Commentat. Societat. Reg. Scient. Göttingen*. Vol. XVI. p. 100. &c.

wanting in many Families and Genera of cryptogamic plants, in the same manner as in the Zoophytes and various Mollusca of the animal kingdom, are distinguished, at least in by far the greater number of cases, by the spirally convoluted fibres (or tubes ?) entering into the composition of their parietes, and having the appearance of woven silk.

§ 163. However varied the reticular and other connexions (Anastomoses) of these vessels may be, no relation can be detected between them, of such a nature as to keep up a circulation of fluids, such as is found in all red-blooded, and so many white-blooded animals.

§ 164. By the simple uniformity of the organic elements of plants, (*partes similes*,) may be explained the facility of the conversion of their compound parts (*partes dissimiles*) into one another; of the leaves into the calyx or corolla of the blossom, particularly in double flowers*; the possibility of planting trees reversed in the ground, so that their branches are converted into roots, and their roots, on the contrary, into branches covered with leaves†.

§ 165. The particular parts of plants compounded of their organic elements, and the functions of those parts, may be conveniently arranged, according as they relate to the preservation of the individual, or to its propagation. We shall speak first of the former.

§ 166. Plants derive the materials necessary to their support partly from the atmosphere, and partly from water, or earth impregnated with it. They obtain their nourishment from the former, by means of the absorbing vessels dispersed in incalculable numbers under the cuticle, particularly in the leaves; and from water, by means of their root fibres, which are renewed every year, and by which most of them are immediately attached to the ground; whilst some, as the Mistletoe, Vanilla, &c. are fixed on other plants‡; whilst some

* See M. VON GOETHE, *Versuch die Metamorphose der Pflanzen zu erklären*. Gotha. 1790. 8vo.—And especially on the identity of the tuberosity and the stalk, (in the Potatoe for instance.) WESTFELD, in VOIGT'S *Neues Magazin*. B. 6. S. 378.

† M. MARCELLIS has a whole alley of Lime-trees planted in this way on his estate, Vogelsang, on the Leyden Canal, near Haarlem.

‡ There are also plants which appear to be rooted in the ground, and which are, in reality, attached by their root-fibres to the roots of other plants, and nourished in that way; as for instance, the *Hydnora Africana*, or the *Euphorbia mauritanica*; &c. See *Schwed. Abhandl.* B. 39. S. 132.

others, as the Water lily, merely float upon the water's surface. — (§ 3. *Remark.*)

§ 167. However different the habits of plants in this respect may be, water, whether in the fluid state or dissolved in vapour, appears to serve as the vehicle for supplying them with carbonic acid, which, according to the experiments of INGEN-HOUZ * is the principal material serving for the nutrition of vegetables. In this way it is intelligible how the Hyacinth-bulb will grow in water, and Cresses on moist flannel; others, as the House-leek, on the roofs of houses; and how many others, and those very succulent plants, natives of the hottest and most parched regions, can, during a long time, derive sufficient nutriment by absorption from the air†.

§ 168. The root fibres, the most universal of all the external organs of nutrition or ingestion in plants, shoot out leaves in many cases immediately above the surface of the ground; in others, however, they previously unite into a common trunk (of roots); and this again, is in many instances elongated into a stem, stalk or haulm, the structure of which, however, is essentially the same with that of the trunk of root-fibres.

§ 169. The stem of trees and shrubs is covered externally with a very fine cuticle, under which lie the bark and the liber (Bass), the latter consisting almost entirely of the most active sap vessels, and consequently, one of the parts most essential to the support of the plant. Placed more internally, is the alburnum (sap); next to it is the true wood, and next, the medulla, (pith) partly within the interstices of the wood, partly down the middle of the stem, its quantity gradually diminishing as the age of the tree increases. In plants of this kind too, one, or more properly, two new layers of wood are produced yearly, probably by the alburnum, whence it is possible, from the number of such concentric layers, to form an estimate of the probable age of the plant.

Remark. The wood of Palms forms an exception to this disposition, in which no such concentric layers exist, the

* VOIGT's *Neues Magazin*. B. 1. St. 2. 1798. S. 101. &c.

† As the *Epidendrum flos æris*.—See J. DE LOUREIRO, *Flora Cochinchinens*. T. 2. p. 525.—“*Mirabilis hujus plantæ proprietates est, quod ex sylvis domum delata, et in aëre libero suspensa, in multos annos duret, crescat, floreat, et germinet. Vix crederem, nisi diuturna experientia comprobasset.*”

trunk being equally dense throughout, very hard, and apparently traversed by partial tubes of alburnum. This circumstance is of importance in assisting the decision as to the nature of fossil woods.

§ 170. The trunk generally divides into branches; these again into twigs, on which the leaves are placed, being, however, essentially the same in composition with the root or the stem, in as much as it is possible to distinguish in them cuticle, bark, woody substance, and medullary cellular structure. The latter occupies the middle of the leaf, between the two reticular layers of woody substance, from which the other parts may be removed by corrosion and similar processes, leaving a skeleton leaf, as it is called. This reticular woody substance is covered on both sides of the leaf with a peculiar membrane, generally called cuticle, but differing materially from the proper cuticle already mentioned, (which is really expanded over the outer surface of the leaves,) and penetrated by numerous absorbing vessels. (§ 166.)

§ 171. This organization of the leaves is worthy of notice, in proportion as the functions which they perform are more extensive and important to the plants on which they are placed. They serve, in particular, for the execution of the phlegistic process, which, in animals, is effected principally by the inspiration of the respirable part of the air on its basis, oxygen; and which, in plants, is performed almost exclusively by the leaves.

§ 172. In plants also, this respirable gas or its basis is, as in animals, indispensable to the support of life: particularly, as INGEN-HOUSZ's experiments have rendered probable, for the purpose of preparing in their vital laboratory, their principal material of nutrition, carbonic acid, the excess of which they subsequently exhale in the form of carbonic acid gas.

§ 173. This important process is carried on in its greatest activity in the dark. During the day-time, on the contrary, and particularly in sun-shine, it is much more languid: hence, at such time, plants prepare and consume carbonic acid in smaller quantities; and, on the contrary, evolve oxygen, the respirable part of the atmosphere, from their leaves.

§ 174. The leaves, however, those important organs, are in most plants of cold climates but a temporary ornament, existing during Summer, and withering and falling off on the approach of Winter. It is probable that this fall of leaves is

caused by the frost which plunges plants into their Winter sleep, and as in animals, retards the course of their juices, and constricts their vessels, so as to render the leaves unfit for their former functions : in support of this idea, it may be remarked, that plants of warm climates, with few exceptions, do not cast their leaves, and that even in cold climates, those in which the leaves are firm and resinous, as most kinds of Pine, Ivy, the Whortle-berry, (*vaccinium vitis idæa*), Heath, the Box-tree, &c. remain green through the Winter.

Remark. On the other hand, as among animals, there are some which are most active during Winter, copulate in that season, and so forth,—so also, there are many plants of which the vegetation is then most vigorous, as the Black Hellebore, Meadow-saffron, Snow-drop, &c.

§ 176. It is remarkable in many plants, that on the approach of evening, their leaves or their blossoms close and recline, apparently sinking into a state of rest resembling sleep ; a phenomenon too, which does not depend on the cold of the evening air, as it occurs in the same manner in the hot-house : and scarcely on the absence of light, as many sleep in Summer even until noon ; nay, as some nocturnal animals devote the day to sleep, such is also the case with the blossoms of certain Plants, for instance, of the Cactus *grandiflorus*, Mesembryanthemum *noctiflorum*, Hesperis *tristis*, &c.

§ 176. Besides this, many plants display real motion of other kinds ; such, for instance, is the tendency which they evince to follow light*, so extremely essential to them in various ways, a tendency existing in most plants, as well as the Sun-flowers, but particularly in hot-houses, where, from this cause, the blossoms often appear as though they had been pressed against the windows†. Many parts of certain plants

* See the Petersburg Prize-Essay by P. HEINRICH, on the Nature and Properties of light. 1806. 4to.

† The following exemplification of this tendency, is taken from the Memoirs of the American Academy of Arts and Sciences at Boston, Vol. II. p. 147.—In the Spring, a potatoe was left behind in a cellar, where some roots had been kept during the Winter, and which had only a small aperture for light at the upper part of one of its sides. The potatoe which lay in the opposite corner to this aperture, shot out a runner, which first ran twenty feet along the ground, then crept up along the wall, and so through the opening by which light was admitted. See also R. BERTUCH's *Beobachtungen an der Indianischen Kresse. Allg. Deutsch. Garten Magaz.* 1804. St. 5. S. 226.

have very considerable motion when they are touched ; for instance, the Sensitive Plant (*Mimosa pudica*,) the *Averrhoa carambola* in their leaves and twigs,—and the anterior appendages of the leaves of the Venus Catch-fly, (*Dionea muscipula*,) which, when even a gnat lights upon them, close together, and crush it instantaneously.

§ 177. The motion which is observed at the time of impregnation in the sexual organs of many hermaphrodite flowers, is still more remarkable, and often very considerable : thus, for example, the stamina of the common Barberry, when touched on their inner side, (that turned towards the germen)—as may happen when an insect settles on the flower, to suck the honey from its basis,—suddenly move inwards, and strike their anthers against the female stigma, by that means effecting the fecundation.

§ 178. But remarkable as all these motions may be, and however strong the evidence they afford, of the actual existence of vital powers in plants, when submitted to accurate physiological examination, they are found altogether distinct from voluntary motion, the exclusive property of animals, and of which not the least trace is discernible even in those plants which have been most famed for their motions, such for instance as the *Hedysarum gyrans*.

Remark. At least I am not acquainted with any single animal that procures its nutriment *without*, or any plant *with* voluntary motion.

§ 179. From the nutritive matter which plants thus absorb and assimilate, the specific juices peculiar to them are subsequently secreted ; thus, many contain milky, and occasionally acrid fluids ; others afford gum ; and various trees, particularly of the Pine kind, when advanced in growth, prepare resin. Various parts of certain plants, contain flour, manna, wax, fixed and essential oils, camphor, &c. ; some few afford caoutchouc, Indian-rubber, as it is called*. To this head also, be-

* Among the most remarkable products of the secretory process in plants, is the Tabasheer, long celebrated, but not properly understood until a very recent period. It is a whitish blue substance, transparent at the edges, rather hard and brittle, occasionally found in the joints of the tube of the Bamboo, and bearing a resemblance to the mineral Hydrophane, as well in its external appearance, and its transparency in water, as in its component elements. See Dr. PATR. RUSSEL and J. L. MACIE, in the *Phil. Trans.* Vol. LXXX and LXXXI.—And Dr. DAV. BREWSTER, in the same work for 1819.

long the specific exhalations of certain plants, as for instance, that from the *Fraxinella* (*Dictamnus albus*), in which it is resinous and inflammable.

§ 180. It is evident, however, that these different juices must be prepared in the plant itself, by various secretions and changes of the nutritive fluids which it absorbs : thus we find, that in the same climate, nay even in the same spot of ground, Rue has its bitter, Sorrel its acid, and the Lettuce its cooling juices ; and that the juices of various parts of one plant, or even of one fruit, are extremely different.

§ 181. At the same time it must be allowed, that the differences of soil* and climate contribute in a considerable degree to the differences in the composition of the juices of plants. Thus, there are some plants which, when transplanted into a foreign soil, deteriorate as well in their form as their nature, lose some of their qualities, and so forth ; whilst others are in an equal degree ameliorated by the same operation.

§ 182. In general, almost every soil nourishes plants peculiar to and suited to it†, so that in many cases it is possible to estimate the nature of a soil by the kinds of plants on its surface. But Providence has endowed many of the plants most important to the human species with the valuable properties, either of adapting themselves to a great variety of climates, as the apparently delicate species of grain thrive in different regions much better than the Oak, and other trees which seem much more hardy, and as the Potatoe, a native of Chili, is now dispersed over every part of the world; or that, when confined to any individual climate, they are capable of flourishing there in every kind of soil, as the Coco-palm, for instance, vegetates vigorously in sandy and stony, as well as the richest earth.

§ 183. On the other hand, it is also remarkable, that certain countries, South Africa and New Holland, for example, exclusively produce a great variety of distinct and peculiar Genera of plants, whilst entire and considerable Orders are wanting in extensive portions of the earth. Thus, the Torrid Zone has

* *Der Boden und sein Verhältniss zu den Gewächsen*; von G. F. W. CROME. Hannov. 1812. 8vo.

† F. STROMEYER, *Historiæ vegetabilium geographicæ specimen*. Gött. 1800. 4to.

A. DE HUMBOLDT, *Essai sur la Géographie des Plantes*. Paris, 1807. fol. And his *Prolegomena de distributione geographica Plantarum*, at the head of his *Nova Genera et Species*.

scarcely any Species of plants of the Cabbage and Turnip kind : so also, comparatively few Mosses are found in the West Indian Islands, and, on the contrary, a great variety of Ferns:

§ 184. Another notable difference in the growth of plants, which also exists in the animal kingdom, particularly among Insects, is, that many are solitary, and as it were, isolated ; whilst others are closely associated, and often, as the common Heath, cover large portions of the earth, or, as the Sargasso (*fucus natans*), of the Sea.

§ 185. The various modes of the propagation of plants may ultimately be reduced to three principal kinds : First, by roots or branches ; secondly, by buds ; and lastly, by seeds.

§ 186. The first kind, by branches, of which some traces are observable in the animal kingdom, among Polypes and others, is in plants much more common. Many naturally propagate in this way, and in others, the process has been imitated by art, in the formation of layers. In the Banian-tree (*ficus indica*,) the branches are pendant, and shoot out roots as soon as they touch the ground, so that a single tree of this kind in time resembles a little wood, the stems of which are connected above by arches.

Remark. Some miles from Patna, in Bengal, is a tree of this kind, with fifty or sixty connected trunks, its diameter being 370 feet, and the shadow which it casts at noon, upwards of 1100 feet in circumference.

§ 187. The second kind of propagation, by buds, is less common. They are the little tubercles which appear on trees in Autumn, at the point of insertion of the leaf-stalks, but which, in most cases, do not open and expand until the following Spring. They are found chiefly on the trees of cold climates, and in some, fall off spontaneously, or occasionally, when carefully placed in the ground, germinate like seeds. As is well known, these buds may be *inoculated*, or even the shoot which they contain, inserted into other trees. (*Budding.*)

§ 188. Bulbs have a considerable resemblance to buds, except that the latter are found above the surface of the ground in trees, whilst bulbs, which are peculiar to liliaceous plants, are attached to the roots under-ground ; in the one case, the trunk continues to live, and supplies the bud with nourishment ; in the other, on the contrary, the whole plant, with the exception of the roots and bulb, perishes in Autumn. This

mode of propagation has considerable resemblance to that of tuberous plants, (Potatoes, &c.)

§ 189. The third kind of propagation, by blossoms, which subsequently ripen as fruit, or in other ways into seeds, is much more common, and occurs in almost the whole of the vegetable kingdom. The flower, whatever may be its form, whether it be single, or whether several be connected together in a cluster, a spike, a catkin, &c. contains, in the middle on the receptacle, parts having distinct forms, of which some are male, the others female, the latter, at the time of impregnation, being fecundated by the former. In respect to their object and their functions, these vegetable organs have considerable similarity to the organs of generation in animals. They differ, however, remarkably in one particular, viz. that in plants they are not congenital, and do not remain through the whole term of life, new organs being prepared for each process of generation.

Remark. The observation already made (§ 136.) that the life of many Insects may be prolonged by retarding the period of propagation, is also, to a certain extent, applicable to the blossoms of many plants. Thus the sexual organs of the female Hemp continue to live a considerable time, if they are not fecundated by the pollen of the male plant; as soon as this fecundation takes place, they wither immediately.

§ 190. The female organs are generally placed in the middle; they are called by the common name of pistil, and consist of the germen, the style, and the stigma. The germen is placed either with the other parts within the corolla, (germen superum,) or, as in the Rose, Apple, &c., below it, (germen inferum.) It contains the seeds, and on that account may in some degree be compared with the ovaries of animals. The style is hollow, supporting the stigma above, connecting it with the germen, and all three forming a common cavity.

§ 191. Round these female parts are placed the male, the stamina, consisting of two parts, the filaments and the anthers, which they support. The anther is covered with a farinaceous, and generally yellow powder (POLLEN); which, however, when considerably magnified, is found to consist of delicate little bags, in many plants having very singular forms, and containing an inconceivably fine powder, which, from its destination, is commonly compared to the semen of male animals.

Remark. The yellow pollen of many plants is occasionally blown, or in wet weather, washed away in abundance ; and falling on stagnant waters, canals, &c., may probably have suggested the supposed rains of sulphur.

§ 192. At the time of fecundation, this pollen falls on the female stigma. It appears to burst there, and to eject its subtle powder, which probably penetrates to the germen through the style, and impregnates the seeds, previously barren, enclosed within it. If, previous to the time of fecundation, the flower be deprived of any of these essential parts, it becomes barren as decidedly as an animal after it has been castrated.

§ 193. In most plants, the organs of both sexes exist together in the same flower, and they are consequently hermaphrodite. (§ 20.) In others, on the contrary, they are placed in separate flowers, of which some contain the male, and some the female organs, both kinds of flowers, however, existing on the same plant, (Monoecia. LINN.) as for instance in the Hazelnut, the Walnut, the Cucumber, the Bread-fruit tree, &c. Other plants have flowers of three kinds, viz. male, female, and hermaphrodite ; such are the Maple, Ash, &c. In others, again, as in Palms, the Hop, Hemp, &c., the two sexes are separated on the plants, as is the case in all red-blooded and many other animals : so that one plant bears male, and another of the same kind female flowers only ; the fecundation of the latter being effected only when the pollen of the flowers of the male plant is conveyed to them by the wind, by means of Insects, or by the interposition of art. (Dioecia. LINN.)

§ 194. Amongst the other parts of plants, not altogether universal, but yet existing in most, the calyx and the nectaries are deserving of notice. Flowers in general are divided according to their form and the disposition of their parts, into regular and irregular ; in the former, all the individual parts of the same kinds, for instance, the leaves of the corolla are of similar form, size, and proportion ; in the latter of unequal proportions.

§ 195. The discoveries of HEDWIG have shewn that the organs of fecundation in the true Mosses (*musci frondosi*) are more similar to those of other plants than was formerly supposed. The delicate and nearly cup-shaped little head (*capitulum*) contains the seeds in the manner of a germen. The seeds, through the medium of the little pointed cap (*calyptra*)

which supplies the place of the style and stigma, are fecundated by the male pollen of certain rose or star-shaped parts, and are subsequently ejected.

§ 196. In those simple plants, however, which live in water, the Tremellæ, Ulvæ, Confervæ, and Fuci, the mode of propagation is very different, though in most of them as yet but imperfectly examined: in many of them, as the *Conferva fontinalis* already mentioned, (§ 9. Remark—§ 20.) it is wonderfully simple. (*Abbild. Nat. Hist. Gegenst. Tab. 49.*)

§ 197. Still less is known of the mode of propagation of Fungi, Mushrooms, Truffles, &c., and of Mucor, their Natural History in general being very obscure*.

§ 198. In perfect plants, which really blossom, all the superfluous parts of the flower fall off after fecundation is completed; and the impregnated germen begins to increase in size, and to bring to maturity the seeds, of which the number is often very considerable†.

§ 199. The form, as well of the different seeds‡, as of the coverings in which they are inclosed, is as various as that of the flowers, and adapted in the most admirable manner to the preservation of the Species as regards their extended dispersion§, their security, &c. The provision, too, is remarkable, by means of which, whatever may be their position in the ground, when they germinate, invariably shoot their radicle (rostellum) downwards, and the plumula upwards||. The new plant is nourished in the first instance, at least in most cases, by the double seed-leaves, (cotyledones), which originally formed the principal bulk of the seed.

§ 200. Many seeds are contained in a covering resembling wood, but considerably firmer, and when of tolerable size and firmness called a Nut. When the seeds are covered by a fleshy or succulent cellular substance, the covering is called a

* Dr. PERSOON is inclined to consider them as plants, in which only the parts of fructification appear.—VOIGT's *Mag. B. 8. St. 4. S. 80.*

† L. C. RICHARD, *Analyse der Frucht und des Samenkorns*, translated into German (with Additions by the Author,) by F. S. VOIGT, Leipzig. 1811. 8vo.

‡ JOS. GAERTNER *de fructibus et seminibus plantarum*. Stutz. 1788-91. 2 Vol. 4to.—And a 3d Vol. C. F. GAERTNER *carpologia*. Lips. 1805. 4to.

§ See RÜSEL's *Insecten—Belustigungen*. B. 2. Preface to the Water Insects of the second Class.

|| See J. HUNTER's experiments in his *Treatise on the Blood, Inflammation, &c.* 4to. p. 237.

Berry, and that even if it be of considerable size or grow on a large tree, as is the case with the Bread-fruit. In some cases the seeds are placed externally on the receptacle, which is fleshy and of considerable size; such as the Strawberry, which therefore is, strictly speaking, not a berry.

§ 201. Fruit trees form a very peculiar and distinct family of plants, which either contain a core with pippins, as the Apple, Pear, Quince, &c., forming the Order *pomaceæ*; or, as in the Plum, Cherry, Appricot and Peach, inclose a stone, being called Stone-fruit, and the trees *drupaceæ*.

§ 202. The causes of degeneration (§ 15-16.) appear to operate more readily upon the *Nisus Formativus* in plants than in animals, and to be more capable of producing a change or deviation in its direction*: hence many of them have degenerated into very numerous varieties, partly as to their general form, but particularly with regard to the flowers and fruit. Thus, at the present time, the varieties of the Tulip are reckoned at three thousand, though the yellow stock kind was the only one known in Europe 200 years back. So also the stalk (§ 168.) is in many plants merely a consequence of degeneration, appearing in the cultivated state of those which, when wild, are *acaules*;—the *Carlina acaulis* and others, for instance. On the other hand, many plants, when cultivated, lose parts which they possess when in a state of nature; thus the wild *Lawsonia spinosa* of India, becomes *inermis* by cultivation in Syria.

In general also, plants are subject to many kinds of degeneration which cannot occur in animals, such for instance, as the conversion of the male organs of fecundation into petals in double flowers, and so on.

§ 203. The degeneration of plants by bastard impregnation (§ 14.) is particularly remarkable; a point on which KÖLREUTER performed many ingenious experiments, and by the repeated impregnation of fertile bastard plants, ultimately converted one Species of Tobacco (*Nicotiana rustica*), into another, (*Nicotiana paniculata*),† a fact which ill coincides with the doctrine of the supposed preformed germs, but perfectly with that of the *Nisus Formativus*. (§ 9.)

* DAV. HOPKIRK, on the *Anomalies in the Vegetable Kingdom*. Glasgow, 1817. 8vo.

† See the *third Appendix* to his *Essay*, as already quoted. p. 51,

Remark. So also bastard plants may accidentally be formed in gardens, when two distinct, but yet connected, Species flower near each other at the same period.

§ 204. Monstrosities, also, are infinitely more numerous among plants than animals, and incomparably more abundant among the cultivated than the wild kinds. (*Remark.* § 12.) These monstrosities occur in all parts of plants, but in some with unusual frequency*. The most common instances are of increase in the number of parts, (*monstra per excessum.*)—as for instance, double stems connected together, double or multiple fruits, ears of corn, &c.; roses with others growing from the centre, and so on.

§ 205. The duration of life in plants differs so much that in many it is scarcely an hour, whilst in others it is extended to several centuries†. In general, however, they are divided into *perennial* and *annual*, the latter perishing at the end of their first Summer.

Remark. There are some instances in the vegetable kingdom, of the kind of revival already mentioned in speaking of the Wheel-animal and Eel of Vinegar; particularly in the *Tremella nostoc*, famed from this circumstance. I have considered this remarkable occurrence in my Treatise—*De vi vitali sanguini denegunda*. Götting. 1795. 4to.

§ 206. Want of space compels me to speak briefly of the uses of plants. I have already (§ 172, &c.) noticed the great influence which they exert upon the atmosphere by their phlogistic process; by means of which, they, on the one hand, incessantly abstract from it, and apply to their own nutriment, the irrespirable carbonic acid gas, as constantly formed by animals; and on the other, exhale oxygen gas from their leaves when exposed to light.

§ 207. In certain parts of the World, particularly the low islands of the Torrid Zone, vegetation of trees especially, is of the utmost importance by attracting clouds, and in that way providing for the watering of the soil‡.

§ 208. Various kinds of vegetables, roots, fruits, &c., serve

* G. F. JAGER, *über die Missbildungen der Gewächse*. Stuttg. 1814. 8vo. Plates.

† See HUFELAND'S *Makrobiotik*. Th. 1. p. 58. Edition 3d.

‡ Compare J. R. FORSTER'S *Stoff zur künftigen entwerfung einer Theorie der Erde*. S. 14. with the *Voyage de LA PEROUSE autour du Monde*. Vol. II. p. 81.

for the food of the most important domestic animals, properly so called; and of the two Species of Insects under the protection of man, Bees and Silk-worms.

§ 209. With regard to the immediate utility of plants to man himself, there are some which are capable of supplying nearly all the wants of particular nations, in the same manner as the Seal, Reindeer, &c. among animals. Of such a kind is the Cocoa-palm, to the Malay Race in particular; to a certain extent, the Date-palm to many people of the Caucasian, and the common Birch to many of the Mongolian Race.

§ 210. Of the articles of vegetable food for the human race, the various fruits eatable without any kind of preparation deserve the first place. Such are, in hot climates, Figs; Dates (from the *Phoenix dactylifera*); Plantains (from the *Musa paradisiaca*); Bananas (from the *Musa sapientum*); among the Malay nations, the Bread-fruit, (*Artocarpus incisa*)*, which only needs to be peeled and roasted; in Hindostan, Ceylon, &c. the Jacca, another kind of Bread-fruit, from the *Artocarpus integrifolia*. So also, many other kinds of berries, (for, as already mentioned, the Bread-fruit is a berry,) afford a most valuable supply of food to various people, the Laplanders, for example. Of like use are the Chesnut, Cocoa-nut, &c.

§ 211. Next come those which require some preparation, as Roots, Turnips, Truffles, Potatoes, Jerusalem Artichokes (*Helianthus tuberosus*), and in both Indies—the Batatas (*Convolvulus batatas*); in the warmer parts of America, Yams (*Dioscorea alata, sativa* &c.); Manioc (*Jatropha manihot*), and others: also the various siliquose and leguminous plants. The various kinds of grain; no longer found in the wild state: Maize (*Zea mays*); Buck-wheat (*Polygonum fagopyrum*); Rice (*Oryza sativa* and *montana*), principally in the East; Millet (*Holcus sorghum*), in China, and many parts of Africa; Teff (*Poa abyssinica*), among the Abyssinians. So also, the celebrated Lotus Berries, (from the *Rhamnus lotus*), among the Loto-phagi†. Some other plants, of which particular parts are

* This very important tree has been introduced into the West India Islands since 1792, by the great Navigator, Captain BLIGH. I have given an account of its success there, in VOIGT's *Neues Magaz.* B. 1. St. 2. S. 110.

† At the present time, the Negroes in the anterior of Africa, prepare from it a well-tasted kind of ginger-bread and a very favourite drink.—MUNGO PARK'S *Travels in the interior Districts of Africa.* Lond. 1799. 4to. p. 100. pl. 1.

used by certain nations as their ordinary food ; as Sago, (from the *Cycas circinalis*, &c.) Gum Senegal, (from the *Mimosa Senegal*), &c.

§ 212. Under this head are included the various kinds of Spices; Sugar, commonly procured from the Sugar-Cane, but also from other plants,—in Europe from the Beet; in North America, from the Sugar-Maple (*Acer saccharinum*): in Iceland, from the *Fucus saccharinum*: in Sumatra, from the Anu-Palm; in Kamtschatka, from the *Heracleum sibiricum*; &c. oil, vinegar, &c., used as additions to food. Excellent butter in the interior of Africa, from the Butter-tree (*Shea toulou*)†. Betel (*Piper betle*), for chewing; Tobacco, for Snuff.

§ 213. Among the articles which are employed as beverage, are the milky fluid of the immature Cocoa-nut, and various kinds of beer; among others, Spruce-beer, from the *Pinus canadensis*; the different vinous liquors; the juice of the Grape; Palm-wine, from the female *Borassus flabellifer*, and from the female Cocoa-palm; other intoxicating liquors, as brandy, arrack, rum, &c. The fermented liquors from chewed roots, as among the Brazilians from their Cassava, and the South Sea Islanders from the *Piper latifolium*. Opium, employed for the same purposes. Tobacco, for smoaking; and Hemp, &c., used in the same way. Our three kinds of fluids taken warm, Tea, Coffee, Chocolate. The Paraguay Tea of South America, from some Species of the Genus *Cassine*; and the Tea of the Mongols, from a wild shrub, but imperfectly known, with leaves resembling those of the Mountain-ash.

§ 214. For the purposes of clothing: Cotton, (the flocculent fibres covering the seed-membrane in the fruit-capsules,) from the different Species of *Gossypium* and *Bombax*; the sap-vessels of Flax, Hemp, several Species of Nettle, &c., for making linen; the excellent silky Flax of New Zealand, from the *Phormium tenax*; the manufactures of the South Sea Islanders from the inner bark of the *Broussonetia papyrifera*, and of the Bread-fruit tree.

§ 215. For fuel; besides the great variety of common wood, some particular kinds employed in certain places; as for instance, on the Alps, *Rhododendron ferrugineum*; on Heaths, *Erica vulgaris*.—For the same purpose, Turf, (chiefly

† MUNGO PARK, *l. c.* p. 224-352. pl. 5.

composed of *conferva rivularis*, *Sphagnum palustre*, *Carex caespitosa*, *Myriophyllum spicatum*, &c.); Coal, Touch-wood, &c.

§ 216. For the construction of houses and ships, a great variety of timber, (and in India, the *Bambos arundinacea*.) For thatch, and other purposes, reeds, straw; and, in the South Sea Islands, the Palmetto-leaves from the *Pandanus tectorius*. For forming fences, hedges, &c., a variety of shrubs. For the protection of dams against the Tereido, &c., the Sea-wire, (*Zostera marina*,) also employed for stuffing cushions.

§ 217. Many different kinds of wood* are employed in a great variety of ways in arts and manufactures, by carpenters, cabinet-makers, turners, &c. So also the various kinds of Canes†; and both for the purpose of instruments of defence in many nations; for instance, the beautiful wood of the *Casuarina equisetifolia* for the ingeniously constructed spears and other weapons of the South Sea Islanders.

Cocoa-nut Shells and Calabashes, (from the *Crescentia cujete*,) with others, used as drinking vessels.

Canes, Osiers, the Bark of the Cocoa-nut tree, &c., for making baskets.—Cork, &c.

Many vegetable substances used for dyeing, (as Indigo,) tanning, washing, &c; others for making paper, paste-board, paper-hangings, &c.

Gum, employed for many well known purposes.—Resin, Pitch, Tar, Lamp-black; Wax (from the *Myrica cerifera*, &c.) Tallow (from the *Croton sebiferum*.)—Oils, Varnishes, &c. (The very costly Japaneze Lac-varnish from the *Rhus vernix*.) Soda and Potash.

§ 218. Most of the materials used in writing are obtained from the vegetable kingdom: as Reeds, Papyrus, (*Cyperus papyrus*,) &c.

§ 219. Lastly, the number of medicinal plants of importance is considerable, the knowledge of which composed nearly the whole of the medicine of the ancients, as it does at present of many nations.

* We may notice here the drift-wood (Poplar, Larch, &c.) of the utmost importance to the inhabitants of the Coasts of the Northern polar countries, without which those icy regions, where no trees grow, would be uninhabitable.

† See an account of the uses for which the Chinese employ the *Bambocane* in VAN BEEAM, *Voyage de l'Ambassade*, &c. Philad. 1797. 4to. T. I. p. 314, &c.

§ 220. On the other hand, weeds, in the most extended sense of the word, (including the destructive Fungi of wood, *Merulius destruens* and *vastator*, together with the microscopic Fungi, *Uredo segetum*, &c., causing smut, rust, &c. in Grain,) and poisonous plants are injurious.

§ 221. Of the numerous Systems of Plants which have been proposed since the time of CÆSALPINUS, the sexual system of LINNÆUS, and that of JUSSIEU, have been most generally adopted and followed in modern times. The former is founded upon the number and relations of the organs of fecundation already described. The latter, on the contrary, is deduced principally from the presence, the absence, and the nature of the seed-vessel; on the relative position of the stamina; and from the absence, the presence, and the form of the corolla.

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SECT. XI.

OF MINERALS IN GENERAL.

§ 222. Minerals or Fossils are those unorganized natural bodies (§ 2-4.) which are formed by physical and chemical laws within and upon the Earth.

§ 223. With the exception of some few liquid Minerals, as Mercury and Petroleum, most are solid; although they have formerly existed in the fluid state.

§ 224. For it is demonstrable, that at least the firm crust of our planet, as deep as it is known, (which, in truth, is not to

* On these geogenetical principles, indispensable in the philosophical study of Mineralogy, see J. A. DE LUC, *Lettres sur l'Histoire physique de la Terre*. Paris, 1798, 8vo.—And MAYER's *Lehrbuch über die Physische Astronomie, Theorie der Erde, &c.* Göttingen, 1805, 8vo.

the amount of $\frac{1}{8000}$ of the semidiameter of the Earth,) must itself have been originally fluid*.

§ 225. It is more than probable too, that the primordial fluid formed a universal menstruum, holding in solution the substances afterwards precipitated from it.

§ 226. Consequently, the various mineral strata have derived their origin from successive precipitations, and other chemical processes, gradually occurring in this fluid, and in a chronological point of view, may be arranged in two principal divisions : viz.

- (A.) The Primitive, formed previous to the organized Creation, and
- (B.) The Secondary, which has been formed at a time subsequent to the existence of Plants and Animals.

Each of these again is subdivided into two Classes :—

The Primitive into

- (a.) The Granite Rocks ; and
- (b.) Rocks containing Mineral Veins.

The Secondary into

- (c.) The Flötz Rocks ; and
- (d.) The Alluvial Strata.

Of each of these we shall say a few words.

§ 227. The first great and general precipitation of which we find the most evident traces, gave origin to the true Granite, which appears to form the primary and essential part of the crust of our planet ; serving as a substratum to the more recently formed mountains and strata ; and occasionally breaking its way out from beneath them, particularly in the largest and most elevated mountain-chains. It is on this account, that the Granite-rocks are named in Geology, primitive or fundamental.

§ 228. The proportions of the contents of the primordial fluid (§ 224.) necessarily changing after each successive precipitation, it follows that the various strata deposited subsequently to the Granite must differ, as well from it as among themselves. These rocks of the second Class are for the greater part of slaty texture, (as for instance, Gneiss, Mica-slate, Clay-slate, &c.) and stratified in extensive layers ; the strata being in general distinguished by their inclined or subverted disposition.

In these strata too, which rest, or, as it were, lean, upon the primitive rocks, fissures and crevices commonly present them-

selves, filled to a greater or less extent with extraneous fossils, apparently of more recent origin* It is in these more recent depositions, or veins, as they are called, (*Ger. Gänge. Fr. Filons.*) that Ores are most commonly found, whence they form the principal and most important object in practical mining.

From them also, the mountains of this second Class are distinguished as mountains containing veins, (*Ger. Ganggebirge. Fr. Montagnes à filons.*) because in them are found, though not exclusively, the most numerous and the richest metallic veins.

§ 229. As already mentioned, the solid crust of our planet was composed of these two Classes of primitive rocks, previous to being enlivened by vegetation, and animated by the animal Creation. For, in neither one or other, is there any trace of petrifications of previously existing organized bodies.

The fact is just the reverse, as far as regards the two Classes of secondary rocks and strata.

§ 230. The Flötz rocks are also for the most part stratified, but with strata in general, more level than those of the rocks containing veins, and much more diversified, as regards their component parts. In general too*, they form only the lower parts of mountain-ridges. They are, however, more particularly distinguished from the two Classes of primitive rocks by the abundance of petrified remains of organized bodies which they almost always contain. Most of these petrifications are of *Incognita*; i.e. without any corresponding originals in the present organized Creation; as for instance, the Belemnites, some hundred Species of Ammonites, &c. All analogy, however, tends to prove, that the greater number of these Incognita were marine animals; and at the present day they are found in these strata in a regular undisturbed position (the Conchylolitha as on an Oyster-bed, the Coralliolitha as on a Coral-reef, &c.), so that we cannot avoid concluding, that the dry land now existing, must once have formed the bed of the Sea of the former world, and must have been elevated from its submersed condition by some sudden and violent revolution.

* A. G. WERNER'S *neue Theorie von der Entstehung der Gänge*. Freyb., 1791. 8vo.

* In general:—for occasionally, mountains of this third Class are found considerably more than 1000 toises above the surface of the Sea; (as in Europe, among the Pyrenées and the Savoy and Swiss Alps,) and on the other hand, primitive rocks much less elevated; for instance, the Brocken, on the Hartz, the highest part of which is only 573 toises above the level of the Sea.

The mountains of this Class have received their name from the word Flöze, applied by the German miners to the variously alternating strata composing them.

§ 231. Besides these three principal Classes of mountains, properly so called, which have all been formed, though at very different times, by depositions from water, and which collectively form the solid crust of our planet,—there is a fourth consisting of the Alluvial strata, as they are called, occurring here and there, principally in low countries, but occasionally of considerable size and extent: of this kind are the strata of Sand, Bog Iron Ore, Loam, Marl-tuff, &c., which also contain in abundance, wonderfully well preserved remains of sea-shells in a calcined state; as for instance, in the Falunierie in Touraine, which is a stratum of such shells, amounting, by REAUMUR's calculation, to 130 millions of cubic toises.

§ 232. In addition to these four Classes of mountains and strata formed in the humid way, we meet with a fifth, composed partly of entire mountains, and partly of level strata, which, subsequent to their aqueous origin, have undergone considerable changes from the operation of subterraneous fire, by which they have been, as it were, metamorphosed, and have assumed their present form.

Mountains of this kind, as is well known, are called Volcanos.

The level strata are called scorified, and the fossils peculiar to them are called pseudo-volcanic productions, in order to distinguish them from those actually ejected from Volcanos.

§ 233. However easily and clearly these five Classes of fossils may be distinguished abstractedly, from what has been said of their origin, there can be no difficulty of understanding, that at the boundaries where they come in contact, they must occasionally be connected by imperceptible transitions*.

* On the various kinds of rocks and their Classification, see J. C. W. VOIGT's *Briefe über die Gebirgslehre, Zweyte Ausgabe*. Weimar. 1768. 8vo.

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C. A. S. HOFFMANN's *kurzer Entwurf einer Gebirgslehre* in A. W. KÖHLER's *Bergmännischen Kalender*. 1790. S. 163. And particularly the Orological part of the *Systematisch-Tabellarisches Uebersicht der Mineralkörper* von LEONHARD, MERZ und KOPP. Frankf., 1806. folio.

§ 234. From the consideration of the mode of origin of fossils, as contrasted with the *procreation* of organized bodies, it must be evident, that, with the exception of some of the most simple minerals, as for instance, Diamond, Sulphur, native metals, &c. the characters of the Species* must be less definitely marked in the former than in the latter, and their arrangement in Genera or even Classes much more arbitrary; thus, for instance, Chlorite, Red Chalk, &c. are arranged by some mineralogists with ores, and by others among earthy minerals.

§ 235. As many fossils, otherwise very similar, differ in an infinite manner, as regards the original proportions of their elements, the mode of their connexion, &c., there results an equally great number of variations, with almost imperceptible transitions into each other, the whole forming a series of which the extremes are sufficiently distinct, but between the individual members of which no such definite limits can be drawn, as in the case of organized bodies. This is particularly the case with the metalliferous minerals, but also in some degree with the compound earthy ones.

§ 236. These transitions are still farther increased by the decomposition and dissolution of fossils already existing; for many earthy minerals are gradually altered by the loss of their water of crystallization; many ores by the action of acids, &c.; and thus, for instance, Feldspar is converted into Porcelain-earth, and Copper Pyrites into black oxyde of Copper.

§ 237. Hence it will appear how absolutely necessary it is, in order to obtain a satisfactory knowledge of minerals, to combine the precise determination of their external characters with the examination of their composition by chemical analysis†; recollecting that the relation of the external characters with the composition is by no means constant‡.

§ 238. Among those external characters§ which are most

* DEOD. DOLOMIEU, *sur la Philosophie Minéralogique, et sur l'espèce minéralogique*. Paris, 1801. 8vo.

† F. BOUTERWEK, *über die Möglichkeit einer philosophischen Classification der Mineralkörper*. Götting. 1808. 8vo.

‡ J. F. L. HAUSMANN, *de relatione inter corporum naturalium anorganicorum indoles chemicas atque externas*.—in *Comment. Soc. Reg. Scient.* Götting. recent. Vol. II. 1813.

§ A. G. WERNER, *von den äusserlichen Kennzeichen der Fossilien*. Leipz. 1774. 8vo.

J. F. L. HAUSMANN, *Versuch einer Entwurfszu einer Einleitung in der Gryktognosie*. Braunsch. 1805. 8vo.

certain and most important in distinguishing minerals, are, specific gravity* ; hardness ; above all when it exists, crystallization, which consists in definite form produced by a determinate number of facets, combined in an equally determinate manner ; and cleavage, or the direction of the lamellæ, which in many minerals is regulated by the relation of the external surfaces to the primary crystal or form†. Of a less constant and positive kind are, colour, degree of transparency, lustre, fracture, the streak which many minerals shew when scratched, &c.

§ 239. Physical characters are also of assistance in distinguishing many minerals ; as for instance, fusibility, solubility, phosphorescence, electricity, magnetism, and single or double refraction. And in many cases also, the empirical characters derived from the locality or the nature of the substances with which a fossil is associated, are of great utility for immediate application.

§ 240. In the chemical examination of fossils, (§ 237.) the mode in which they are affected by fire, and particularly by the blow-pipe, will occasionally suffice ; but more frequently it is necessary to have recourse to analysis by means of re-agents *via humida*.

Remark. That the results of analyses of the same fossils by different chemists are occasionally very different, only proves how much attention, caution, and above all frequent repetition are necessary, in order to guard against error and self-deception.

Nor must it be forgotten in the most perfect analysis, that it cannot, and does not, show any thing more than the quality and quantity of the materials into which the fossil is decomposable ; and, on the contrary, that it explains nothing of that which forms the peculiar character of many fossils, viz. the wonderful composition and mode of

* *Pesanteur spécifique des corps* par M. BRISSON. Paris, 1787. 4to.

Remark. The Specific Gravities in this work are estimated in parts of a thousand, that of water being assumed as 1000 at about 64° Fahr. An L prefixed, denotes that it is on the authority of the late M. LICHTENBERG.

† *Theorie sur la Structure des Cristaux ;* par R. J. HAUY in *Journal de Physique*. T. 43. p. 103.

J. F. L. HAUSMANN'S *Krystallogische Beyträge*. Braunsch. 1803. 4to.

connexion of those materials, by which, for instance, Alumina forms the Sapphire, and in combination with a few equally common substances, Tourmaline; or by which Nature produces out of Silex combined with Alumina, Agalmatolite, and combined with Magnesia, Soapstone, in other respects so closely similar. See LICHTENBERG'S *Vermischte Schriften*. B. 5, S. 161.—DE LUC, in VOIGT'S *Magazine*. Vol. IX. p. 1. p. 74.—And KLAPROTH'S *Beyträge*. B. 1. S. 89.

§ 241. Minerals in general, according to the old division, first, I believe, suggested by AVICENNA, may be arranged in four Classes; the distinctions and peculiarities of which are more precisely explained at the commencement of the four following sections.

I. Stones and Earthy Fossils.

II. Salts.

III. Inflammable Minerals, properly so called.

IV. Metals.

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J. G. WALLERII, *Systema Mineralogicum*. Holm. 1772. Vol. II. 8vo.

D. L. G. KARSTEN, *Minerallogische Tabellen*. Berlin, 1808. fol.

F. A. REUSS, *Lehrbuch der Mineralogie nach KARSTEN'S Tabellen*. Leipz. 1801-6. B. 8. 8vo.

Systematisch-Tabellarische Uebersicht und Characteristik der Mineralkörper; von C. C. LEONHARD, R. F. MERZ und J. H. KOPP. Frankft. 1806. fol.

Propädentik der Mineralogie; von C. C. LEONHARD, J. H. KOPP und C. L. GARTNER. Daselbst. 1817. fol.

Taschenbuch für die gesammte Mineralogie, mit Hinsicht auf die neuesten Entdeckungen, herausgegeben von C. C. LEONHARD. Daselbst seit 1807. 8vo.

C. A. E. HOFFMANN, *Handbuch der Mineralogie*. Freyb. 1811. 8vo.

J. F. L. HAUSMANN, *Entwurfe eines Systems der unorganisirten Naturkörper*. Cassel. 1809. 8vo.

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HAUY, *Traité de Minéralogie*. Paris, 1801. 5 Vols. 8vo.

EJ. *Tableau comparatif des Résultats de la Cristallographie et de l'analyse Chimique relativement à la Classification des Minéraux*. Paris, 1809. 8vo.

Tableau méthodique des Espèces Minérales extrait du Traité de Minéralogie de M. HAUY, et augmenté des nouvelles Découvertes; par J. A. H. LUCAS. Paris, 1806. 8vo.

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For the Determination of Fossils by their external Characters.

H. STRUVE, *Méthode Analytique des Fossiles, fondée sur leurs Caracteres extérieurs*. Lausanne, 1797. 8vo.

Handbuch des Mineralogen von H. STRUVE, aus desselben Handschrift übersetzt durch D. B. RATZER. Bern., 1806. 4to.

J. G. LENZ, *Mineralogisches Taschenbuch*. Erf. 1798. 12mo.

On Geology.

J. A. DE LUC, *Traité Élémentaire, de Géologie*. Lond., 1809. 8vo.

Essay on the Theory of the Earth, by M. CUVIER, with *Mineralogical Notes* by PROF. JAMESON, and *Observations on the Geology of N. America*, by PROF. MITCHELL. N. York. 1818. 8vo.

S. BREISLAK'S *Lehrbuch der Geologie, mit Anm. von F. R. von STROMBECK*. Braunsch., seit 1819. 8vo.

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Catalogue de la Collection des Fossiles de Mlle. DE RAAB par M. DE BORN. Vienn., 1790. Vol. II. 8vo.

N. G. LESKE'S *Mineralien-Cabinet*, beschrieben von D. L. G. KARSTEN. Leipz., 1789. 2 B. 8vo.

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GIANV. PETRINI, *Gabinetto Mineralogico del Collegio Nazareno*. Rom.. 1791. 2 Vols. 8vo.

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W. BABINGTON'S *System of Mineralogy in the Form of a Catalogue*. Lond., 1799. 4to.

Des HRN. J. F. VON DER NULL, *Mineralien-Cabinet, als Handbuch der Oryctognosie brauchbar gemacht* von F. MOHS. Wien. 1804. 3. B. 8vo.

SECT. XII.

OF STONES AND EARTHY FOSSILS.

§ 342. Those minerals are known by the name of Earthy Fossils, which, when pure, are not of themselves soluble in water*, as Salts, nor in oil, as Bitumen; nor like the latter, burn in the open fire; nor like metals, admit of extension under the hammer†. In general they are very difficult of fusion, but when melted become transparent. Their specific gravity mostly exceeds that of water four or five times.

§ 343. At the present time nine primitive or elementary earths are known, whence the fossils of this Class are arranged in an equal number of Genera named after them :

- | | |
|--------------|------------------|
| I. Silex. | VI. Magnesia. |
| II. Zircon. | VII. Lime. |
| III. Yttria, | VIII. Strontian, |
| IV. Glucine. | AND |
| V. Alumina. | IX. Barytes. |

I. SILEX.

Silex is not by itself fusible, and is equally unalterable in air and in water; it is not acted upon by any acid except the fluoric; but when combined with the two fixed alkalies, soda and potash, it melts into glass, whence it is sometimes called vitrescible earth.

1. Quartz.

Its proper form when crystallized, is that of a six-sided prism of various length, terminated by six-sided pyramids, the surfaces of the prism being frequently marked with fine transverse striæ.

* They are soluble when combined with acids or alkalies, particularly at a high temperature. For that even siliceous earth itself, combined with soda, is found dissolved in many hot springs, is proved by the siliceous sinter about many of them, (particularly in Iceland and Kamtschatka,) as well as by the analysis of the water. See BLACK, in the *Trans. of the Roy. Soc. of Edinburgh*. Vol. III. p. 119. &c.

† “*Terræ characteres vix nisi privatiui habentur.*”—BERGMANN.

It is hard, and gives a phosphorescent light when two pieces are rubbed together in the dark.

It includes two principal varieties; viz. 1st, Rock Crystal, and 2d, Common Quartz.

(1.) *Rock Crystal*. Ger. *Berg-crystall*. Fr. *Crystal de Roche*. Properly colourless and limpid; lustre vitreous: fracture slightly conchoidal; the crystals generally attached by one extremity to a quartz matrix, and then often weighing a hundred-weight, (particularly in Switzerland and Madagascar); on the contrary, often unattached and perfectly crystallized, i. e. with both pyramids; of this kind the small, but very clear ones, with very short intermediate prisms are worthy of notice; the Hungarian ones, for instance, from the Palatinate of Marmaros. Lastly, very abundant in the form of rounded pebbles, occasionally of extreme hardness and transparency, as for instance, the *keys* of Ceylon. Specific gravity 2653. Contents according to BERGMANN—Silica 93; Alumina 6; and Lime 1. It not infrequently incloses extraneous fossils, as for instance, chlorite, asbestos, actinolite, mica, grey oxyde of manganese, sphene, &c.; and occasionally drops of water. It is rarely, as upon St. Gothard, found perforated by little hollow canals, straight and with six angles.

Among the most remarkable of the coloured Varieties of Rock Crystal are:—

(a.) *Yellow Quartz*. *Citrin*. *Quartz hyalin jaune*. Generally of a wine yellow colour, and rarely crystallized. Of this kind are the large false topazes.

(b.) *Brown Quartz*. Ger. *Rauchkrystall*. Fr. *Quartz hyalin enfumé*.—Smoke-brown in every shade. The darkest is also called *morio*.

(c.) *Amethyst*. Fr. *Quartz hyalin violet*. Generally violet in a variety of shades; sometimes of a compressed columnar structure, partly with fortification-like processes. The finest coloured specimens are found in Persia and the East Indies.

(2.) *Common Quartz*.

One of the most ancient and most generally diffused fossils. Commonly milk-white, but also in a variety of other colours: more or less transparent. Lustre generally vitreous, but occasionally dull; mostly uncrystallized; sometimes crystallized; occasionally pseudo-morphous*; now and then of peculiar

* Exhibiting impressions of the forms peculiar to the crystals of other substances.

form, as notched, cellular, &c. Fracture mostly conchoidal; occasionally splintery or granular. It sometimes assumes a glittering appearance, from a peculiar kind of scaly structure, or from the intermixture of fine lamellæ of mica; such is the cinnamon-brown avanturine quartz from the Cape de Gatte in Spain, called natural avanturine, from its resemblance to the well-known glass composition, avanturine flux. (Avanturin-fluss.)

Two notable varieties are :—

(a.) *Rose Quartz*; so called from its pale red colour, depending on the manganese it contains. Fracture generally amorphous; occasionally in conchoidal scales. It occurs particularly in Bavaria and on the Altai mountains, in large masses.

(b.) *Prase*. It has its name from its leek-green colour, which is derived from the intermixture of actinolite; generally amorphous; found in particular at Breitenbrunn, in the Erzgebirge.

2. Siliceous sinter.—Stalagmitical Quartz. *Ger.* Kieselsinter. Quarzsinter.

Silex is held in solution in hot springs, partly from the elevation of temperature, partly from its combination with soda (§ 242. Note.), and is afterwards deposited in the form of sinter. This substance is white, varying into milk-blue, wax-yellow, &c.; it is but slightly transparent. Like calcareous sinter, (stalactitic carbonate of lime,) its form and fracture are very various; sometimes it appears in the form of drops; or as if melted; botryoidal, &c.: its structure is generally loose, occasionally lamellar, &c. Specific gravity 1917.—Contents of that from Iceland, according to KLAPROTH—Silex 98; Alumina 1.5; Oxyde of Iron 0.5. It is found in abundance and in a great variety of forms near the hot springs of Iceland and Kamtschatka, and the pearl sinter or fiorite, at Santa Fiora, near Florence.

3. Hyalite. *Ger.* Gummistein. Müllerisches glas. *Fr.* Quartz hyalin concrétionné.

Whitish in a variety of shades; more or less transparent; lustre vitreous; stalactitic, fusiform or botryoidal, &c.; sometimes like resin or gum in colour and form; most commonly found incrusting Tuff-wacke.—Contents, according to BUCHOLZ—Silex 92; Water 6.33; with a trace of Alumina. Found chiefly near Frankfort on the Maine.

4. Chalcedony. *Ger.* Chalcedon. *Fr.* Quartz agate calcédoine.

It includes the Onyx, Cornelian, Heliotrope, Chrysoprase and Agate. For the first four differ in little more than colour from common Chalcedony, and Agate is composed of a mixture of these and some other minerals.

(1.) *Common Chalcedony.*

Mostly milk or azure blue; partly, also, passing into the honey-yellow and red of cornelian, the smoke-brown of the onyx, &c. Often streaked and clouded. In many places very common with dendritical marks *, and then called Mocha-stone, Moss-agate, &c. In general more or less transparent; lustre greasy; fracture smooth; often occurring in a variety of peculiar forms, particularly kidney or almond shaped, stalactitic and in balls. The latter found in the Vicenzine, not uncommonly has cavities sometimes containing a drop of water (Hydrocalcedon.) Chalcedony is also found cellular, pseudo-morphous, or crystallized itself, mostly in cubes. Specific gravity, 2615. Many specimens are phosphorescent when rubbed together. That from Faroe contains, according to BERGMANN,—Silica 84; Alumina 16. It passes into Quartz, Horn-stone, Opal; and is found in abundance in Trapp.

(2.) *Onyx.*

Smoke-brown, sometimes passing into black-blue; often with alternate layers of milk-blue Common chalcedony, (the Arabian Sardonyx. *Ital.* Niccolo.) Very commonly employed by the ancient Romans for cameos.

(3.) *Cornelian.* Ger. *Carneol.* Fr. *Cornaline.*

Flesh-red, passing on one hand into wax-yellow or horn-brown, and on the other into the darkest garnet-red. Of the latter kind is the most valuable of all, *Corniola nobile* (Fr. *Cornaline de la vieille roche*), which by reflected light is of a black-red, but with transmitted light, blood-red, like a Bohemian garnet, (pyrope,) and almost as transparent. It is upon this that the master-pieces of Grecian and Etruscan intaglios are executed. Its locality is at present unknown.

The Indian Sardonyx, on the contrary, of which the most valuable ancient cameos are composed, mostly consists of horn-brown Cornelian, with layers of Chalcedony.

* These dendritical marks are, particularly in many Oriental specimens, occasionally of the colour of Cornelian or Onyx; more commonly, however, they appear to depend on the presence of Manganese. Many Icelandic specimens contain a greenish web, which, when viewed through a magnifying glass, has, in every respect, the appearance of a conferva.

(4.) *Heliotrope*.

Colour dark leek-green, commonly with blood-red spots; transparent at the angles at least; lustre greasy; fracture conchoidal; uncrystallized. Specific gravity 2633. Found principally in Egypt. Very common in ancient intaglios.

To this Species, also, probably belongs the Plasma or Smaragdo-prase, of a light leek-green colour, mostly with small white or yellow spots; transparent. Its locality is unknown, but probably in Egypt. Very commonly used by the ancient Roman artists for seals, &c.* Of this kind are also the greater number of ancient Smaragds, as they are called.

(5.) *Chrysoprase*.

Mostly apple-green, partly with a bluish play of colour; has its beautiful colour, which is very transient in the fire, from the contained Oxyde of Nickel; translucent; uncrystallized. Contents according to KLAPROTH—Silica 96.16; Oxyde of Nickel 1; Lime 0.83; Magnesia 0.08; Alumina 0.08; Oxyde of Iron 0.08. Found particularly at Kosemitz in Silesia.

(6.) *Agate*.

Agate, as already mentioned, is a mixture of several of the preceding Species, with occasionally an addition of Quartz, principally Amethyst, Jasper, &c.; and occurs in an endless variety of composition, colour and marks. Hence the variety of names, Agate-onyx, Jasper-agate, Ribband-agate, Cross-agate, Point-agate, Fortification-agate, &c. Brecciated-agate consists of fragments of the different kinds connected by a cement of Quartz. Rainbow-agate viewed in transmitted light presents a play of variegated colours. Agate is common in nodules, often hollow. It occurs in great abundance and variety in Germany, particularly the Palatinate.

5. Opal. *Fr.* Quartz-résinite.

The colour is different in the different Varieties; all are more or less transparent; they have commonly a greasy lustre, in some cases dull, in others vivid; their fracture is conchoidal; they are found massive only; and are generally only semi-hard. The principal kinds are: 1st, True Opal; and 2d, Semi Opal.

(1.) *True Opal*, with the following varieties, viz.—(a.) *Noble Opal*. *Precious Opal*. *Ger. Edler Opal*.

Mostly yellow by transmitted light; by reflected light, milk-

* In my *Specimen Historiæ Naturalis antiquæ artis operibus illustrata*, I have treated more fully of this remarkable stone, which has often been mistaken by modern writers and confounded with others.

blue with a peculiar fiery play of iridescent colours. Specific gravity 2114. Contents according to KLAPROTH—Silica 90; Water 10. Found particularly in Upper Hungary.

(b.) *Common Opal*. Ger. *Gemeiner Opal*.

Less transparent; and without the play of colours. A cream-yellow variety has the Mongolian name of Kascholong, (Cacholong; i. e. beautiful stone.) Contents of a specimen from Kosemitz;—Silica 98.75; Alumina 1; Oxide of Iron 1; KLAPROTH. Found in the Erzgebirge, Silesia, the Faroe Islands, &c. It passes into Chalcedony, Chrysoprase, &c.

(c.) *Hydrophane*. Ger. *Weltauge*. Fr. *Quartz résinite hydrophane*.

Mostly cream-yellow; probably produced by the decomposition of the preceding Variety; hence its locality and composition are the same; it is softer; sticks to the tongue; absorbs water and then becomes transparent (whence its name); occasionally iridescent.

(2.) *Semi Opal*. Ger. *Halbopal*. Fr. *Demiopale*, in two Varieties; viz.

(a.) *Pitch Opal*. Ger. *Pechopal*. *Telkobanierstein*.

Commonly wax-yellow (Wax Opal); but also brownish-red, olive-green, &c.; more or less transparent; lustre sometimes vitreous, sometimes greasy; fracture conchoidal. It passes into yellow chalcedony, pitchstone and flint. It occurs in great variety at Telkobanja, in Upper Hungary. Contents—Silica 93.5; Oxide of Iron 1; Water 5; KLAPROTH.

(a.) *Wood Opal*. Ger. *Holzopal*. Fr. *Quartz résinite xyloïde*. The wood of pines petrified in a kind of Wax Opal; yellowish, brownish, &c. The longitudinal fracture is occasionally fibrous and sometimes with the detachment of conchoidal layers corresponding to the annual increase of wood. Found particularly at Schemnitz, in Hungary.

6. *Cat's Eye*. Ger. *Katzenauge*. *Schillerquarz*. Fr. *Quartz agathe chatoyant*.

Generally yellowish or greenish, and sometimes smoke-blue; has a peculiar reflection, from which its name is derived; but little transparent; lustre greasy. It is found in rolled masses in Ceylon and Malabar. Specific gravity 2657. Contents—Silica 96; Alumina 1.75; Lime 1.5; Oxide of Iron 0.25. (KLAPROTH.)

7. *Pitchstone*. Ger. *Pechstein*. Fr. *Petrosilex resinite*.

Of a variety of colours, but mostly inclining to blue; but little transparent; lustre greasy; fracture conchoidal; gene-

rally massive; sometimes kidney-shaped; semi-hard. Specific gravity of a Saxon specimen, 2314. Passes into Wax Opal; occasionally intermixed with grains of Felspar and Quartz (Pitchstone-Porphry.)

8. Menilite. *Ger.* Blauer Pechstein.

Hair-brown, with greasy lustre; transparent only at the thinnest corners; fracture from flat conchoidal to coarse slaty; scratches glass. Contents—Silica 85.5; Alumina 1; Lime 0.5; Oxide of Iron 0.5; Water and carbonaceous matter 11. (KLAPROTH.) In rounded and kidney-shaped masses in the polishing slate of Menil-montant, near Paris.

9. Polishing Slate. *Ger.* Polirschiefer. Klebschiefer. Saugkiesel.

Generally yellowish-white, brownish, and often striped; staining a little; fracture slaty; fine-earthly; meagre to the touch; adheres strongly to the tongue; very soft; light. Contents, Silica 66.5; Alumina 7; Magnesia 1.5; Lime 1.25; Oxide of Iron 2.5; water 19. (KLAPROTH.) Found chiefly at Menil-montant.

10. Tripoli. *Ger.* Tripel. *Fr.* Quartz aluminifère Tripolèen.

Generally yellowish grey; earthy; meagre; soft. Contents, according to HAASE—Silica 90; Alumina 7; Oxide of Iron 3. Found, among other places, at Ronneburg, in the District of Altenburg.

11. Spongiform Quartz. *Ger.* Schwimmstein. *Fr.* Quartz nectique.

Yellowish-grey; dull; not transparent; fracture earthy; very soft; tasteless.—Specific gravity 0.800. Contents, according to VAUQUELIN, Silica 98; Carbonate of Lime 2. Found near Paris, chiefly in globular masses.

12. Pumice-stone. *Ger.* Bimstein. *Fr.* Pierre-ponce.

Generally whitish-grey; lustre silky; spongy; structure irregularly fibrous; brittle; sharply granular; very light. Contents of that from Lipari, according to KLAPROTH, Silica 77.5; Alumina 17.5; Oxide of Iron 1.75. Found in many volcanic countries, as in the Lipari Islands, Santorini, Vera Cruz, &c.

13. Porcelain Jasper. *Ger.* Porcellan-Jaspis. *Fr.* Therman-tide Porcellanite.

Generally pearl-grey or lavender-blue, but sometimes also straw-yellow, brick-red, &c. Fissured; lustre greasy; fracture conchoidal. A pseudo-volcanic product, probably derived from shale (slate-clay.) Found among other places, at

Stracke, in Bohemia. Contents of a specimen from thence, according to ROSE, Silix 60.75 ; Alumina 27.25 ; Magnesia 3 ; Oxyde of Iron 2.5 ; Potash 3.66.

14. Obsidian. *Fr.* Lave vitreuse obsidienne.

Varying from smoke-grey to coal-black ; more or less transparent ; sometimes however only at the edges, as in the antique kind, from the west coast of the Red Sea, of a blackish-grey or leek-green colour* ; lustre vitreous ; fracture conchoidal ; uncrystallized. Contents Silix 78 ; Alumina 10 ; Potash 6 ; Lime 1 ; Oxyde of Manganese 1.16. (VAUQUELIN.) It sometimes contains a mixture of granular portions of Quartz and Felspar, (Obsidian-porphry.) Found particularly in volcanic countries, as Iceland, Ascension, Easter Island, &c.

15. Flint. *Ger.* Feuerstein Kreide-Kiesel. *Fr.* Pierre à feu.

Generally grey, passing into blackish, yellowish ; &c. ; but little transparent ; fracture conchoidal, acutely angular ; mostly in dense masses ; sometimes in hollow balls, of which kind are the melons of Mount Carmel, as they are called ; harder than quartz ; when struck, emits a peculiar smell. Specific gravity 2595. Contents, Silix 98 ; Lime 0.5 ; Alumina 0.25 ; Oxyde of Iron 0.25. (KLAPROTH.) It passes into Hornstone, Semi Opal, &c †. Abundant in chalk-beds. Often contains petrifications of Sea-urchins, delicate corals, cellularia, &c. Occurs in rolled masses in the pudding-stone of Hertfordshire. Principally used for gun-flints ‡.

16. Hornstone. *Ger.* Hornstein. *Fr.* Pierre de Corne. (Petro-silex.)

Commonly grey, passing into a variety of colours mostly dull. At Altai, milk-white, with delicate dendritical marks. (White Jasper.) Transparent at the edges only ; fracture generally splintery ; uncrystallized, but sometimes in pseudo-morphous crystals of calcareous spar ; less hard than quartz. Specific gravity 2708. Contents, Silix 72 ; Alumina 22 ; Lime 6. (KIRWAN.) Passes into Flint, Chalcedony, Jasper, &c. Forms the basis of many kinds of Porphyry.

Sinopel (Ferrum jaspideum BORNII) is a brownish-red Horn-

* I have spoken of this, the true Obsidian of the ancients, in the *Comm. Soc. Reg. Götting. recent.* Vol. III. p. 76.

† Very neat cameos are made in Rome, from fine flint with perfect layers of cream-yellow Semi-Opal.

‡ See B. HACQUET, *physische und technische Beschreibung der Flintensteine.* Wien, 1792. 8vo.

stone, very rich in iron, and forming the principal veins at Schemnitz in Hungary.

Woodstone is wood petrified in a kind of horn-stone; it is of a variety of colours; among others cochineal-red, and more rarely apple-green. Found principally in alluvial strata; but occasionally also in Flötz rocks, (in the *Rothe todte liegende*, a species of conglomerate.)

17. Flinty-slate. Siliceous schist. *Ger.* Kieselschiefer. Horn-schiefer.

Black, smoke-grey, and partly also of other colours, mostly dull; transparent at the edges only; lustre greasy, with a dull glimmering; fracture mostly coarse-splintery, partly scaly; structure slaty; amorphous (not crystallized); hard; often permeated by veins of quartz. Passes into clay-slate.

A Jasper-like variety, called by WERNER *Lydian stone*, varies from black-grey to coal-black, has a more even fracture, and is found chiefly in rolled masses.

18. Ferruginous Quartz. *Ger.* Eisenkiesel. *Fr.* Quartz hématite.

Principally liver-brown; not transparent; lustre greasy; generally amorphous; sometimes in small crystals of six-sided prisms, with six or three-sided terminal pyramids; hard. Contents, Silex 92; Oxyde of Iron 5.75; Oxyde of Manganese 1; volatile parts 1; (BUCHOLZ.) Found particularly in Bohemia, and in the Erzgebirge in Saxony.

19. Jasper. *Ger.* Jaspis. *Ital.* Diaspro.

Of all colours and patterns, whence the names of Ribband-jasper, &c.; not transparent; fracture faintly conchoidal; mostly amorphous; rarely in (primary) kidney-shaped masses; very hard. Specific gravity 2691. Contents, Silex 75; Alumina 20; Oxide of Iron 5. (KIRWAN.) Passes into Horn-stone, ferruginous Quartz, &c.

The *Egyptian Jasper* forms a remarkable variety: it is brown in all shades; sometimes striped or veined; also with dendritical marks; in the form (primary) of pebble; exceedingly susceptible of polish. Specific gravity, 2564. Found chiefly in Upper Egypt.

20. Arenalite.

Dark leek-green; not transparent; partly massive, partly crystallized in broad six-sided prisms, terminated at the extremities by two or four planes. The crystals with vitreous lustre; the fracture greasy; the longitudinal fracture lamellar, the

transverse, conchoidal. Specific gravity, 3640. Contents, Silica 37; Alumina 21; Lime 15; Oxyde of Iron 24; Oxyde of Manganese 1.5 (VAUQUELIN.) Found in the iron mines at Arendal in Norway.

Epidote or *Thallite*, or the *Green Schorl* of Dauphiny resembles it; whence WERNER united both minerals under the common name of *PISTACITE*.

21. *Axinite*. *Ger.* Thumerstein. *Glasstein*. Clove-brown; transparent; lustre vitreous; fracture small conchoidal; amorphous as well as crystallized in flat rhomboids. Specific gravity, 3166. Contents, Silica 50.5; Alumina 17; Lime 17; Oxyde of Iron 9.5; Oxyde of Manganese 5.25; Potash 0.25; (KLAPROTH.) Found principally in Dauphiny and Thum, in the Erzgebirge.

22. *Harmotome*. *Cross-stone*. *Ger.* Kreuzstein. *Fr.* Pierre de la Croix.

Mostly milk-white; transparent, but rarely limpid; the longitudinal fracture lamellar, the transverse conchoidal; always crystallized*, and primarily as small, thick, right-angled, four-sided prisms, bevelled and pointed at the extremities; but almost always as twin crystals, so that two are applied together longitudinally, and appear to intersect each other, (Tab. 2. fig. 15.) giving the appearance of a cross on the transverse fracture. Specific gravity, 2355. Contents, Silica 49; Barytes 18; Alumina 16; Water 15. (KLAPROTH.) Found chiefly at St. Andreasberg, in the Hartz.

23. *Apophyllite*. *Ger.* Fischaugenstein.

Mostly greyish-white; transparent, partly limpid; fracture lamellar; cleavage in three directions at right angles; scratches glass imperfectly. Specific gravity, 2467. Contents, Silica 52; Lime 24.5; Potash 8; Water 15; with traces of Muriate of Ammonia. (ROSE.) Found particularly at Uto in Roslagen (Sweden), and in perfect Crystals at St. Andreasberg.

24. *Prehnite*.

Commonly apple-green; transparent, with faint nacreous lustre; partly amorphous, partly crystallized in short, columnar, four-sided prisms, closely aggregated. Specific gravity, 2942. Contents, Silica 43.83; Alumina 30.33; Lime 18.33;

* L. VON BUCH *über den Kreuzstein*. Leipz., 1794. 8vo.—And J. F. L. HAUSMANN in WEBER und MOHR's *Archiv für die Natur-Gesch.* B. 1. S. 111.

Oxyde of Iron 5.66; Water 1.83. Found principally at the Cape, and in Dauphiny; also on many parts of the Hartz; as crystallized at Goslar.

25. Zeolite. Mesotype.

It has its name (Zeolite) from its principal quality, viz. that of bubbling up into twigs before the blow-pipe, without running into a bead. It is white in a variety of shades; sometimes also brick-red, green; when fresh, more or less transparent; lustre mostly nacreous, particularly of Stilbite (a Variety); when exposed to the weather, on the contrary, not transparent, earthy, or mealy; structure mostly radiated, divergent, partly lamellar (Stilbite); very frequently amorphous; often kidney-shaped; often crystallized, and mostly in six-sided tables or prisms, more rarely in cubes, (Analcime, Cubicite), rhomboidal (Chabasie,) &c. acicular (the limpid Glass-Zeolite, Needle-stone, or Mesolite from Iceland,) fibrous (fibrous and capillary Zeolite); generally half-hard. Specific gravity 2134. Contents of a specimen from Faroe, Silica 49; Alumina 27; Soda 17; Water 9. (SMITHSON.) Found, among other places, particularly in Trap on Iceland and the Faroe Islands. Elsewhere also in many Basalts.

To fibrous Zeolite belongs *Natrolite*; colour cream and orange-yellow; kidney-shaped and mamillary; structure radiated divergent. In the Porphyry-slate of Hohentwyl, in the kingdom of Wurtemberg.

26. Marekanite.

Commonly smoke-grey, partly cloudy; more or less transparent; rarely limpid and diaphanous; lustre vitreous; in round and obtuse-angled grains, mostly about the size of a pea, but sometimes as large or larger than a hazel-nut. Specific gravity 2365. Contents, Silica 74; Alumina 12; Lime 8; Magnesia 3; Oxyde of Iron 1. (LOWITZ.) Found particularly at the mouth of the Marekanka, in the Sea of Ochotsk. Enclosed like kernels in a lamellar cortex of Pearl-stone, both swelling before the blow-pipe like Zeolite.

27. Pearl-stone. *Ger.* Perlstein. *Fr.* Lave vitreuse perlée.

Mostly ash-grey, partly brick-red, both in a variety of shades; but little transparent; lustre sometimes silky, sometimes nacreous; consists of fragments partly granular and detached, partly in curved lamellæ crumbling and friable, in the latter form composing the external layer of the marekanite. Con-

tents, Silex 75; Alumina 12; Potash 4.5; Oxyde of Iron 1.6; Water 4.5. (KLAPROTH.)

28. Lazulite. Azurite. Lapis Lazuli. Sapphirus of the ancients. *Ger.* Lasurstein. *Fr.* Pierre d'azur.

Has its name from the Persian, on account of its fine blue colour; not transparent; fracture dull, almost earthy; often with scattered points of iron pyrites; amorphous. Specific gravity 2771. Contents, Silex 46; Alumina 14.5; Carbonate of Lime 28; Sulphate of Lime 6.5; Oxyde of Iron 3; Water 2. (KLAPROTH.) Among other places, found of exceeding beauty and in large masses on the Baikal Lake. Employed for many purposes of art, and in particular for making ultra-marine.

29. Haüyne. Latialite*.

From lazulite-blue to verdigris-green; more or less transparent; lustre vitreous; hard; generally in grains. Specific gravity 3333. Contents, Silex 30; Alumina 15; Lime 5; Sulphate of Lime 20.5; Potash 11. (VAUQUELIN.) Found chiefly near Albano, accompanied by Mica.

30. Augite. Pyroxéne.

Passing from dark leek-green and colophony-brown into black; but slightly transparent; lustre considerable; longitudinal fracture lamellar; transverse, conchoidal; partly massive; partly crystallized in flat, short, six-sided prisms, with four-sided extremities. Contents, Silex 52; Lime 13.2; Magnesia 10; Alumina 3.33; Oxyde of Iron 14.66; Oxyde of Manganese 2. (VAUQUELIN.) Commonly fixed in Basalt, Tuffwacke, and particularly in the Lavas of Vesuvius and Etna.

Coccolite, a granular Variety of Augite is found principally near Arendal in Norway.

31. Vesuvian. Idocrase.

Generally pitch-brown, partly dark olive-green; but little transparent; lustre externally generally greasy; internally vitreous; always crystallized; particularly in short four-sided prisms with truncated edges, and very obtuse terminal pyramids. Contents, Silex 35.5; Lime 33; Alumina 22.25; Oxyde of Iron 7.5; Oxyde of Manganese 0.25. (KLAPROTH.) Found among the primordial fossils of Vesuvius, but particularly in perfect crystals, sometimes as thick as a thumb, at the entrance of the Achtagar into the Wilvi in Siberia.

The *Loboite*, so called by BERZELIUS after Count VON LOBO,

† LEOP. GMELIN. *de Haüyna.* Heidelb., 1814. 8vo.

to whom we are indebted for the first precise account of this remarkable fossil*, which, in many of its external characters, resembles Vesuvian, differs from it, besides its appearance under the blowpipe, and the absence of any indication of the presence of electricity, more particularly by containing a considerable quantity of magnesia. It is found in a lime quarry near the iron mines of Dannemora in Upland. (Sweden.)

32. Leucite. Amphigéne. *Ger.* Weisser Granat, vulcanischer Granat.

Greyish-white, milky; transparent; but mostly with fissures, and therefore turbid; externally rough; internally with vitreous lustre, and shews a concentric structure on the fracture. Generally crystallized, and for the most part as a double eight-sided pyramid, with four planes at each extremity (Tab. 2. fig. 14.); very brittle. Specific gravity 2468. Contents, Silex 54; Alumina 23; Potash 22. (KLAPROTH.) Found principally in a variety of Lavas and Tuffwacke in lower Italy.

33. Pyrope. *Ger.* Böhmischer Granat.

Blood-red; more or less transparent; lustre vitreous; fracture conchoidal; never crystallized, but in roundish grains, loose or fixed in serpentine, &c. Specific gravity 3941. Contents, Silex 40; Alumina 28.5; Magnesia 10; Lime 3.5; Oxyde of Iron 16.5; Oxyde of Manganese 0.25. (KLAPROTH.) Found particularly in Bohemia and Saxony.

34. Garnet. *Ger.* Granat. *Fr.* Grenat.—Carbunculus.

Passing from carmine-red through pitch-brown into olive-green; of equally various degrees of transparency; lustre mostly vitreous; fracture conchoidal; amorphous, as well as crystallized in a variety of forms; chiefly as dodecahedrons with rhomboidal planes (Tab. 2. fig. 13.); also as the Leucite (Tab. 2. fig. 14.)

The three following kinds of Garnets are distinguished according to the principal colours, of which the first is called Precious Garnet (*almandine*), and the other two Common Garnet.

(1.) *Red Garnet, Oriental Garnet, Almandine.*

Mostly of the red colour already mentioned. Specific gravity 4188. Contents, Silex 35.75; Alumina 27.25; Oxyde of Iron 36; Oxyde of Manganese 0.25. (KLAPROTH.) Found principally in Pegu. It is generally cut *en cabochon*.

* See LEONHARD'S *Taschenbuch* 5. Jahrg. S. 16.

(2.) *Brown Garnet.* Ger. *Eisengranat.*

Pitch-brown, cinnamon-brown, &c. Particularly fine on St. Gothard's; also in the Vesuvian, from Vesuvius.

(3.) *Green Garnet.* Ger. *Grüner Eisenstein.*

Leek-green, olive-green, &c. Specific gravity 3754. Contents, Silex 36.45; Lime 30.83; Oxyde of Iron 28.75. (WIEGLEB.) Among other forms, the *Grossular* as it is called, in perfect crystals resembling those of the *Leucite* (Tab. 2. fig. 14.) in the Vesuvian from the Wilui river. Common Varieties abundant in Thuringia and Misnia, and together with brown garnet on the Spitzenberg, in the Hartz.

35. *Staurolite.* *Staurotide.* *Grenatite.*

From red-brown to black-brown; slightly translucent; always crystallized, mostly in flat six-sided prisms; sometimes in twin-crystals, either at right angles, or as a St. Andrew's cross. (the Basle Font, as it is then called, *Basler Taufstein**) Contents, Silex 30.59; Alumina 47; Lime 3; Oxyde of Iron 15.3. (VAUQUELIN.) Found in Brittany and on St. Gothard, in Mica-slate, and partly with crystallized Cyanite.

36. *Cyanite.* *Disthène.* Ger. *Blauer Schörl.*

Generally sky-blue, partly grey, silver-white; transparent; lustre almost nacreous; fracture long-splintery, radiated and lamellar; mostly amorphous; sometimes crystallized in flat six-sided prisms; so hard in the cross fracture, as sometimes to give sparks with steel; on the contrary, so soft in the longitudinal fracture, that it may be scratched with the finger. Contents, Silex 43; Alumina 55.5; Oxyde of Iron 0.5; with a trace of Potash. (KLAPROTH.) Found particularly on St. Gothard, and Zillerthal, in Salzburg.

II. ZIRCON.

This Earth, discovered by M. KLAPROTH, is soluble in sulphuric and concentrated acetic acids, but not in alkalies. With borax, it forms a limpid bead before the blowpipe, and is found in two precious stones, the Jargon and the Hyacinth.

1. *Hyacinth.* *Lyncurium veterum?*

Mostly orange-yellow, fire-coloured; diaphanous; usually perfectly crystalline; and for the most part in four-sided prisms, terminated by four planes placed on the angles. (Tab.

† See C. BERNOULLI, in VOIGT'S *Neu. Mag.* B. 4. S. 524. Tab. 8.

2. fig. 20.) Specific gravity 3687. Contents, Zircon 70; Silex 25. (KLAPROTH.) Found chiefly in Ceylon*.

2. Jargon. Zircon.

Mostly yellowish-brown; occasionally in various pale colours, particularly yellowish, bluish, &c.; transparent; lustre peculiar, almost metallic, and yet somewhat greasy: crystallized in four-sided prisms, with four terminal planes corresponding to the sides (Tab. 2. fig. 7); very hard. Specific gravity 4475. L. Many specimens are magnetical. Contents, Zircon 69; Silex 26.5; Oxyde of Iron 0.5. (KLAPROTH.) Found in Ceylon and Norway; in the latter at Friedrichswärn, in a Semi-granite. composed of opalescent Felspar and Hornblende.

III. YTTRIA.

This Earth, discovered by PROF. GADOLIN, is distinguished from Glucine and Alumina, with which it coincides in many of its properties, among others by its insolubility in caustic fixed alkalies, and by the precipitation of its muriatic solution by tannin and the salts of prussic acid.

1. Gadolinite. Ytterite.

Black; not transparent; brilliant; fracture small conchoidal; semi-hard; powerfully magnetic. Specific gravity 4237. Contents, Yttria 52.5; Silex 13; Glucine 4.5; Oxyde of Iron 16.5. (EKEBERG.) Found at Falun and Ytterby, in Roslagen (Sweden.)

IV. GLUCINE.

This Earth, discovered by M. VAUQUELIN, resembles Alumina in many particulars, but is distinguished from it by not forming alum with sulphuric acid. Its name is derived from its forming with acids, salts which are sweet and slightly astringent.

1. Beryl. Aquamarine. *Fr.* Aigue marine.

Sea-green in a variety of shades, passing on the one hand into sky-blue, on the other into honey-yellow; transparent; longitudinal fracture conchoidal; transverse, lamellar; crystallized in six-sided prisms with many varieties. Specific gravity 26.83. Contents, Glucine 16; Silex 69; Alumina 13; Lime 0.5;

* Very few precious stones from Africa are yet known, but I have received from Sir J. BANKS a coarse sand, collected on the Cape Coast by the botanist W. BRASS, containing many grains perfectly resembling Hyacinth, and some small fragments approaching to the Spinelle.

Oxyde of Iron 1. (VAUQUELIN.) Found particularly on the Adonschelo, between Nertschinsk and the Baikal Lake ; also a greenish-grey, &c., almost untransparent Variety in large prisms near Chauteloup. (Department of Haute Vienne.)

2. Emerald. *Ger.* Smaragd. *Fr.* Émeraude.

It has given a name to its principal colour. It crystallizes in six-sided prisms (Tab. 2. fig. 10.) with many varieties. Specific gravity 2775. Contents, Glucine 13 ; Silex 46.6 ; Alumina 14 ; Lime 2.56 ; Oxyde of Chromium 3.5. (VAUQUELIN.) Found principally in Peru.

3. Euclase. Euclaseite.

Generally greenish-white ; transparent ; lustre vitreous ; longitudinal fracture lamellar ; with lamellæ in two directions ; hence easy to cleave. Cross fracture conchoidal ; crystallized in oblique four-sided prisms ; hard. Specific gravity 30.62. Contents, Glucine 12 ; Silex 35 ; Alumina 22 ; Oxyde of Iron 3. (VAUQUELIN.) Found in the Brazils.

V. ALUMINA.

Alumina (terra argillosa, aluminosa,) in combination with sulphuric acid, forms alum. It is also soluble in nitric and muriatic acids, and is precipitated from the solution by potash. Singly, it is infusible in fire ; it hardens there, and contracts considerably, and in proportion to the degree of heat. Many aluminous fossils, when breathed on, emit a peculiar (aluminous) odour. The softer ones generally adhere to the tongue, and many absorb water, thereby becoming tenacious.

However strange it may at first sight appear, many coloured precious stones must be included in this Genus, some of them, as the most perfect analysis proves, consisting almost exclusively of Alumina, which is formed in an incomprehensible manner into transparent, sparkling gems of great hardness. — (§ 240.)

1. Chrysoberyl. Cymophane.

Generally wine-yellow, passing into asparagus-green ; with a bluish opalescence ; transparent ; lustre vitreous ; fracture conchoidal ; mostly amorphous in grains ; rarely crystallized in eight-sided prisms terminated by similar pyramids. Specific gravity 3710. Contents, Alumina 71.5 ; Silex 18 ; Lime 6 ; Oxyde of Iron 1.5. (KLAPROTH.) Found in the Brazils.

2. Topaz.

(1.) *Precious Topaz.* *Ger.* Elder Topas.

Yellow in a variety of shades ; partly also on one hand, passing into rose-red, on the other, into sea-green, bluish, &c. ; longitudinal fracture conchoidal ; the transverse lamellar. Generally crystallized, and usually as four or eight-sided prisms, which in the Brazilian Topaz, are terminated by pyramids with four, six or eight planes (Tab. 2. fig. 16.), but in the Saxon by truncated six-sided pyramids. (Tab. 2. fig. 9.) Specific gravity of the Brazilian 3515. L. This also displays electricity like tourmaline. Contents of the Saxon, Alumina 49 ; Silex 29 ; Fluoric Acid 20 : (VAUQUELIN.) Found, in Europe, principally near Auerback in Voigtland on the Schneckenstein, in a peculiar matrix (Topaz Rock. Topasfels); in Asia, particularly near Mukla, in Natolia, and on the Ural mountains, in Siberia ; in America, Brazils.

(2.) Common Topaz. *Pyrophysalite. Physalite. Leucolite. Pycnite. Shorlaceous beryl.* Ger. *Stangenstein. Weisser stangenschörl.*

Yellowish and greenish white, partly also, reddish ; but little transparent ; cross fracture lamellar ; in aggregated columnar prisms, partly in six-sided crystals. Specific gravity 3530. Contents, Alumina 49.5 ; Silex 43 ; Fluoric Acid 4 ; Oxyde of Iron 1 ; Water 1. (KLAPROTH.) Found principally near Altenburg, in the Erzgebirge, in a matrix composed of Mica and Quartz.

3. Ruby. Spinelle.

Red in a variety of shades ; hence the names ; the poppy-red being called Spinelle ; the rose-red, Balais ; the hyacinth-red, Rubicelle, &c. : it sometimes passes also into bluish, whitish, &c. Its crystallization is various ; mostly as double four-sided pyramids (Tab. 2. fig. 5.), or as six-sided prisms or tables, in many varieties. Mean specific gravity 3700. Contents, Alumina 74.5 ; Silex 15.5 ; Magnesia 8.25 ; Lime 0.75 ; Oxyde of Iron 1.5. (KLAPROTH.) According to VAUQUELIN, only Alumina with Magnesia 8.78 ; Oxyde of Chrome 6.18.

4. Sapphire. Télésie.

Mostly blue in a variety of shades ; passing into white (White Sapphire), and occasionally even into wine-yellow*, of which kind are probably many of the so called East Indian Topazes ; properly transparent ; occasionally somewhat opalescent :

* Sometimes even yellow and blue in the same specimen ; thus in the *Inventaire des Diamans de la Couronne*, &c. Imprimé par ordre de l'Assemblée Nationale. Paris, 1791. T. 1. p. 200. No. 4. " *Un Saphir d'Orient—Couleur Saphir des deux bouts, et Topaze au milieu.*"

crystallized in six-sided pyramids, double or single. (Tab. 2. fig. 18.) The hardest stone of the Genus. Mean specific gravity 4000. Contents, Alumina 98.5 ; Oxyde of Iron 1 ; Lime 0.5. (KLAPROTH.) Found only in rolled masses, and principally in Ceylon.

5. Adamantine Spar and Corundum*.

The former smoke-grey, the latter generally apple-green, rarely passing into hair-brown ; both but little transparent ; of diamond-like lustre, and sparry structure ; crystallized in short six-sided prisms, sometimes becoming somewhat conical. Mean specific gravity of the Chinese as well as the Indian, 3911. L. Contents of the latter, Alumina 89.5 ; Silex 5.5 ; Oxyde of Iron 1.25. (KLAPROTH.) Found in Granite, in China and Coromandel. Used in those countries for cutting and polishing gems and steel†.

Under the name of *precious Corundum* are included the fine coloured Varieties, particularly ruby-red and sapphire blue, also found in the East Indies, of which the former are called Salam-Ruby, and the latter Star-Sapphires, because, particularly when the extremity of the prism is rounded off, they display a star with six rays when they reflect light.

Andalusite, Feldspath apyre, is closely related to Adamantine Spar ; it is generally of peach-blossom-red, occasionally (viz. in the Tyrol,) crystallized in four-sided prisms, and occurs in Gneiss and Mica-Slate.

6. Emery. Ger. Smirgel. Fr. Emeril.—Smiris.

Black-grey, partly into Indigo-blue, &c.; transparent at the edges ; glittering, sometimes with almost metallic lustre ; fracture small-granular, or splintery. Very hard. Specific gravity (variable), 3922. Contents, also variable ; but always, according to TENNANT, a considerable quantity of Alumina, with a little Silex and Oxyde of Iron. The true Emery ‡ is found, among other places, in Estremadura, Naxos, and Eibensstock, in the Erzgebirge.

7. Agaphite, Turquoise. Solid Hydrate of Alumina.

* See C. GREVILLE on the *Corundum-stone from Asia*. Phil. Trans. 1798. P. 1.

† This remarkable fossil is noticed even by THEVENOT in his *Voyages*. T. 3. Paris, 1684, 4to. p. 292.

‡ For many other Fossils, (Woodstone, for instance, in many parts of Thuringia,) are called Emery, from being employed in the same manner to polish hard Stones, Glass, Steel, &c.

From sky-blue to verdigris-green ; the former most valuable ; decomposes into mountain-green ; not transparent ; in little knobby, botryoidal, kidney-shaped masses. Specific gravity 2900. Contents, Alumina 73 ; Water 18 ; Oxyde of Copper 4.5 ; Oxyde of Iron 4. (JOHN.) Comes principally from Nischabur, in East Persia, and occurs in aluminous strata among Slate. It is commonly, but incorrectly, considered as a petrification, viz. of the teeth of fish.

8. Schorl and Tourmaline.

In the colours hereafter mentioned ; lustre partly vitreous, partly greasy ; fracture generally conchoidal. Partly in rolled masses, but commonly in three, six, or nine-sided prisms, striated longitudinally, and terminated by short three-sided pyramids (Tab. 2. fig. 12.) Many Varieties display a remarkable degree of electricity, so that when heated to a moderate degree, they attract and repel ashes, &c. ; these are called Tourmaline.

(1.) *Black or Common Schorl and Tourmaline.*

Commonly coal-black, not transparent ; but partly brown or green, translucent in thin splinters. Fracture vitreous. Generally in long prisms (Columnar Schorl), or needle-shaped ; partly in short thick prisms. Occurs in Granite as well as many other rocks, particularly Gneiss, Chlorite Slate, Topaz Rock, &c. Met with in almost all parts of the world ; as in the Tyrol, Greenland, Madagascar, &c.

(2.) *Brown Tourmaline.*

By reflected light black-brown ; by transmitted light almost colophony-brown ; transparent ; like the black, partly in long prisms (as on the Pyrenees), partly in grains (as in Ceylon). Contents, Alumina 39 ; Silica 37 ; Lime 15 ; Oxyde of Iron 9. (BERGMANN.)

(3.) *Red Schorl. Siberite. Daurite. Rubellite.*

Commonly carmine-red ; semi-transparent ; the prisms striated longitudinally, partly columnar, aggregated. Specific gravity 3043. Contents, Alumina 40 ; Silica 42 ; Soda 10 ; Oxyde of Manganese 7. (VAUQUELIN.) Of this kind, also, is the crystallized *Lepidolite* from Rozena, in Moravia.

(4.) *Blue Schorl. Indicolite.*

Mostly dark indigo-blue ; transparent at the edges only ; lustre vitreous, approaching to metallic ; hard ; generally in needle-shaped, aggregated prisms, striated longitudinally. Found at Uto, in Sudermania.

(5.) *Green Tourmaline. Peridote.*

Chiefly leek-green; partly passing into steel-blue; transparent; the prisms generally deeply grooved. Specific gravity 3600. Contents, Alumina 50; Silex 34; Lime 11; Oxyde of Iron 5. (BERGMANN.) Found in the Brazils.

9. *Dichroite. Iolite.*

Dark violet-blue; translucent at the edges; lustre vitreous; hard; rarely crystallized in small six-sided prisms. Specific gravity 2560. Contents, Silex 49.17; Alumina 33.10; Magnesia 11.48; Oxyde of Iron 4.33. (STROMEYER.) Found in Bavaria, Spain, Greenland, &c.

10. *Hornblende. Amphibole.*

Black and green with many shades and transitions. Not transparent, or slightly translucent; fracture generally lamellar; streak greenish-grey. Specific gravity 3600 to 3900. When breathed on, emits the peculiar aluminous odour.

Of the particular kinds there deserve notice:—

(1.) *Common Hornblende. Fr. Roche de corne striée.*

Radiated, fascicular, &c. One of the oldest and most widely dispersed Fossils of our planet, and forming one of the most usual components of many spurious Granites.

(2.) *Hornblende Slate. Ger. Hornblendeschiefer.*

Generally with short fibres radiated and intermixed; in wedge-shaped fragments.

(3.) *Basaltic Hornblende.*

Mostly in short six or eight-sided prisms, partly tabular, and terminating in an edge or a point by two or three planes. Generally implanted in Basalt and Tuffwacke; also intermixed in Lava.

11. *Schiller Spar. Ger. Schillerstein, Schillerspath. Fr. Diallage metalloïde*.*

Brass-yellow, passing into green; scarcely translucent; lustre metallic, glittering; lamellæ rectilinear; soft. Contents, Alumina 17.9; Silex 43.7; Magnesia 11.2; Oxyde of Iron 23.7. (GMELIN.) Found in the Forest of Harzburg, on the Hartz, in a greenish-black Greenstone, intermixed with Serpentine and Asbestos.

12. *Mica. Ger. Glimmer.*

* J. C. FRIESLEBEN, *über das schillernde Fossil von der Baste bey Harzburg.* Leipz. 1794. 8vo.—And J. F. L. HAUSMANN *in den Norddeutschen Beyträgen zur Berg und Hüttenkunde.* St. 1. S. 1.

Generally smoke-grey in many shades, partly with silvery or brass-like lustre, or tombac-brown passing into black; more or less transparent; commonly with straight lamellæ, rarely with curved (as in *Mica hemisphærica*. LINN.) The former in sheets as large as paper, as in the Muscovy Glass*, (*Russ. Sliuda*. Ger. *russische Frauenglas*); the lamellæ are elastic and flexible; generally amorphous; but sometimes crystallized, and most commonly in six-sided tables. Specific gravity 2934. Contents of the Muscovy glass, Alumina 34.25; Silex 48; Potash 8.75; Oxyde of Iron 4.5; Magnesia and Oxyde of Manganese 0.5. (KLAPROTH.) One of the most ancient and most generally diffused Fossils in the crust of the earth; and found in all three of the principal kinds of rocks. (§ 227-230.)

13. Lepidolite. Lilalite. *Fr.* Mica grénu.

Lilac-red passing into grey, brownish, &c.; translucent at the edges; glittering; lustre almost metallic; fracture uneven, micaceous, in small scales; semi-hard. Contents, Alumina 38.25; Silex 54.5; Potash 4; Water 2.5; Oxydes of Iron and Manganese 0.75. (KLAPROTH.) Found near Rozena, in Moravia, in a rock composed of Felspar and large fragments of Quartz.

14. Cryolite. *Fr.* Alumine fluatée alkaline.

Almost milk-white; translucent; lustre vitreous; structure with thick lamellæ; soft. Specific gravity 2957. Fuses readily before the blow-pipe into a milk-white bead. Contents, Alumina 24; Fluoric Acid 40; Soda 36. (KLAPROTH.) Found in Greenland.

15. Tetraclasite, Scapolite with Wernerite or Fettstein and Sodalite, &c. Paranthine.

From greenish-grey to yellowish-grey, leek-green, &c.; translucent; hard; massive, or crystallized in four-sided prisms. Contents (of Scapolite), Silex 50.25; Alumina 30; Lime 10.45; Oxyde of Iron 3; Oxyde of Manganese 1.45; Potash 2; Water 2.85. (JOHN.) Generally found in Gneiss, in Norway and Sweden; the Sodalite in Greenland.

16. Felspar. Ger. Feldspath. *Fr.* Spath étincelant.

Of a variety of colours, mostly faint; but little translucent; generally with true sparry texture; partly amorphous, partly

† See BARON VON ZACH's *Monathl. Corresp.* B. 3. p. 239. for an account of the remarkable property possessed by the Muscovy Glass, of transmitting the rays of light perfectly parallel, and of the astronomical purposes to which it can consequently be applied.

crystallized in various ways ; a very common ingredient in compound rocks ; occasionally intermixed with other Fossils, as Quartz or Hornblende.

The five following Varieties are distinguished :—

(1.) *Compact Felspar*. Ger. *Dichter Feldspath*.

Without any evident sparry texture ; of this kind is the pale leek-green, in the *Serpentino verde antico* from Egypt.

(2.) *Common Felspar*. Ger. *Gemeiner Feldspath*.

Generally whitish, yellowish, reddish, &c., but occasionally in other and more brilliant colours ; as for instance, emerald-green, with nacreous lustre in the Amazon stone from Catharinaburg ; structure evidently sparry ; frequently crystallized in (single or twin crystals) tables, bevelled or acuminate at the extremities, or in rhombs, four-sided prisms, &c. Many kinds readily disintegrate into Porcelain Clay. Sp. Gravity of the Emerald-green kind from Siberia, 2573. L. Contents of the same, Silica 65 ; Alumina 17 ; Lime 3 ; Potash 13. (VAUQUELIN.) Common Felspar in particular, is one of the most ancient Fossils of our Planet, as a principal ingredient in Granite, of which, in many instances, it constitutes by far the greatest proportion *.

(3.) *Vitreous Felspar*. Ger. *Glasiger Feldspath*.

Partly colourless and limpid ; partly white ; lustre vitreous ; amorphous, as it is found implanted in many Basalts ; or crystallized in prisms and tables ; the former in the Granite of Drachenfels, on the Rhine ; the latter on Vesuvius.

(4.) *Adularia*. Moonstone. Ger. *Mondstein*.

Generally white ; translucent ; lustre nacreous ; opalescent ; crystallized almost as common Felspar ; Specific gravity, 2561. Found chiefly on the Adula, Mount St. Gothard, occasionally in large crystals, and the true Moonstone, as rolled masses in Ceylon. Similar to this, is the Avanturine Spar (Feldspath—Avanturino) from the White Sea ; a pale, flesh-red Felspar, intermixed with lamellæ of Mica, of a gold-like lustre, and the divided surfaces opalescent, with a fine blue reflection.

(5.) *Labrador Felspar*. Ger. *Labradorstein*.

Its principal colour is generally blackish-grey, but glittering

* As in the remarkable Portsoy Granite of Aberdeenshire ; a mass of Felspar, so perviated by fragments and lamellæ of Quartz, that when cut in certain directions it has the appearance of a Cufic inscription, whence it has been called *pierre graphique*. See VOIGT'S *Magazin*. B. 6. St. 4. S. 21.

by reflected light in a variety of brilliant colours, and sometimes with brass or tombac lustre; translucent. Specific gravity, 2692. Found particularly in Labrador in rolled masses, and in Ingermannia.

Under Felspar, WERNER has also classed *Chiastolite*. Ger. *Hohlspath*. Fr. *Macle*, a remarkable Fossil, of white or yellowish-grey colour; in long, slender, four-sided prisms, which display in the centre of the cross fracture a four-cornered spot, of which the angles correspond to those of the prism. Its lustre is vitreous; its fracture fine splintery; and it scratches glass. Specific gravity, 2944. It occurs in Clay Slate, particularly in Brittany, and Gefrees, in Bayreuth.

17. *Aluminite*. Ger. *Reine* (so genannte) *Thonerde*. Chalk-white; fracture earthy; brittle; giving a stain; meagre to the touch; generally in small reniform masses.—Specific gravity, 1669. Contents, Alumina 30.26; Sulphuric Acid 23.36; Water 46.37. (STROMEYER.) Found principally near Halle.

18. *Porcelain Clay*. *Kaolin*. Ger. *Porcellanerde*. Whitish, passing into a variety of pale colours: meagre; soft to the touch; of different degrees of consistence. Composition various, but usually about one fourth Alumina and three fourths Silex. Found in many countries of Europe and Asia. Produced, at least for the most part, by the disintegration of Felspar.

19. *Clay*. Ger. *Gemeiner Thon*. Fr. *Argile*. Generally of a grey colour, passing into others by a variety of transitions; dull; soft; greasy to the touch; fracture most commonly tending to slaty; emits the argillaceous odour when breathed on. To it belong:—

(1.) *Potter's Clay*. Ger. *Töpferthon*. Fr. *Argile plastique*. Very soft; becomes tenacious in water; generally burns brick-red; varies exceedingly in appearance, fineness, composition, and consequent utility; as for *Terra cotta*, China, and earthenware, tobacco-pipes, Turkish pipe-heads, crucibles, bricks, fulling of coarse cloth, refining sugar, &c. It is found principally in alluvial strata.

Among the Varieties of Potter's Clay, remarkable on account of the articles into which they are formed, are:—

(a.) That of which the well-known ancient Greek and Etruscan Vases were manufactured, distinguished by their extreme lightness.

(b.) That of which the Portuguese *Bucaros de Estremoz* are made, having a very astringent taste, which they impart to the liquids contained in them.

(c.) That from which the remarkable Bladder-ware, (*Blasentöpfe*,) with large cells in its substance, is made at Szent-Laszlo, in Transylvania.

(2.) *Indurated Clay*. Ger. *Verhärteter Thon*. *Thonstein*.

Of various colours and degrees of consistence; fracture generally fine-earthly; occasionally forms the cement of many kinds of Porphyry. Employed in some places as a building stone.

(3.) *Slate Clay*. *Shale*. Ger. *Schieferthon*. *Zechstein*.

Generally smoke-grey, passing into black; fracture slaty, lamellar; many Varieties adhere strongly to the tongue*; often marked by the impressions of plants. It is a usual attendant on true Coal, and passes into Clay Slate, Porcelain-Jasper, &c.

When impregnated with Bitumen, it is called Bituminous Shale. Ger. *Brand-schiefer*; burns with a resinous odour, and becomes of a brighter colour. It can also be employed for many purposes of Fuel, and is therefore reckoned as Coal by some Mineralogists.

20. *Loam*. *Limus*. Ger. *Lehmen*. *Leimen*.

Generally liver-brown; coarse earthy; softens in water; intermixed with Sand and Lime, whence it effervesces with Acids, and occasionally fuses readily; mostly containing Iron. Found in alluvial strata.

21. *Bole* (of Mineralogists.) *Terra Lemnia sive sigillata*.

Generally liver-brown, passing into flesh-red; greasy; fracture conchoidal; streak brilliant; soft; adheres to the tongue; it falls to pieces in water, emitting numerous air-bubbles; when breathed on, gives out the argillaceous odour. Found chiefly on the Island of Stalimene (*Lemnos*.)

22. *Fuller's Earth*. *Argilla fullonum*. Ger. *Walkererde*.

Mostly liver-brown, but also in other colours; partly streaked or spotted; fracture dull, earthy; greasy to the touch; gives

* Of all known Fossils, this character is most evident in the ash-grey Hygrometric Slate, found by Lowitz the younger, in 1772, near Dmitriewsk, at the entrance of the Kamyschinka into the Wolga; its name being derived from the object to which it was applied by that able Chemist, and of which he has given an Account in LICHTENBERG'S *Götting. Mag.* B. 1. St. 4. S. 401, &c.

a brilliant streak and has the argillaceous odour. Readily absorbs oil, &c., whence its utility. Contents, Alumina 25; Silex 51.8; Lime 3.3; Magnesia 0.7; Oxyde of Iron 3.7; Water 15.5. (BERGMANN.) The best found in Hampshire.

23. Mountain Soap. *Ger.* Bergseife.

Partly brownish-black, partly yellowish-white, with grey and liver-brown veins; fracture soapy, very greasy to the touch; adheres strongly to the tongue and may be sliced. Found principally near Medziana Gora, in Poland.

24. Lithomarge. Stone-marrow. Lithomarga. *Ger.* Steinmark.

Whitish, but passing into other colours by many transitions; sometimes striped or marbled, as in the violet-blue kind, from Planitz, near Zwickau; of various degrees of consistence, from friable to half hard*; the latter with conchoidal fracture.

Here, also, is placed the officinal Armenian Bole, brick-red, and generally sprinkled with white. And similar to this, at least in external appearance, is the Sinopian Earth, celebrated among the ancients, and so called from the place where it is found.

Also the milk-white Lithomarge, discovered by the late Von TREBRA in the deepest galleries of the George Mine, near Clausthal, in Greywacke, which gives a phosphorescent streak when scratched with a pen.

25. Agalmatolite. *Ger.* Bildstein.

Varying from white to yellowish, greenish, red; more or less translucent. Specific gravity 2600. In its external characters has a general resemblance to Soap stone, but does not contain any Magnesia. Composition, Alumina 36; Silex 54; Oxyde of Iron 0.75; Water 5.5. (KLAPROTH.) Found in China, where it is made into a variety of little articles.

26. Red Chalk. Rubrica. *Ger.* Röthel. *Fr.* Crayon rouge.

Blood-red, brick-red, &c; earthy; leaving a stain; fracture generally slaty. Specific gravity 3931. Intermixed with Red Ochre in small proportion.

27. Yellow Earth. *Ger.* Gelberde.

Ochre yellow, or brick-red; earthy; leaving a stain; soft;

* I possess a cream-yellow, very fine grained, Lithomarge of this kind, from St. Helena, which retains its finest edges unaltered, in a temperature at which Iron melts.

with a powerful argillaceous odour. Found in entire strata, in Upper Lusatia particularly.

28. Green Earth. *Ger. Grünerde. Grüne Kreide.*

Mountain green in different shades; fracture earthy; partly massive, as near Verona; partly as a covering of drusy cavities in Trap (Amygdaloid) and of the contained reniform masses of Chalcedony and Zeolite, as near Ilfeld, and in the Faroe Islands.

29. Wavellite. Hydrargillite. Phosphate of Alumina.

White in a variety of colours; generally with nacreous lustre; partly earthy; partly radiated and translucent; in the latter case, half hard. Contents, Alumina 37.2; Phosphoric Acid 35.12; Water 28. (FUCHS.) Found in Devonshire (in Flinty Slate,) and in Bohemia (in Sandstone.)

30. Alum Clay. *Ger. Alaunthon.*

Like common Clay, in the following three Varieties, being distinguished from it principally by its sweetish, astringent, aluminous taste.

(1.) *Alum Earth. Ger. Alaunerde. Lebererz..*

Chiefly black-brown; fracture earthy; streak glittering; often in entire strata. Passes into Brown Coal.

(2.) *Alum Stone. Ger. Alaunstein.*

White, passing into yellowish, greyish, &c., and burning red; partly somewhat transparent at the edges, and more so when lying in water; half-hard; sometimes leaving a stain. Contents, Alumina 43.92; Silica 24; Sulphuric Acid 25; Sulphate of Potash 3.8; Water 4. (VAUQUELIN.) In entire strata near Tolfa, in the States of the Church.

(3.) *Alum Slate. Ger. Alaunschiefer.*

Greyish, partly passing into black; occurs in tables, sometimes with straight, sometimes with curved lamellæ; sometimes in balls; the fracture sometimes dull, sometimes brilliant; very frequently intermixed with Iron Pyrites; it sometimes occurs, but by no means exclusively, in veins, as Clay Slate, from which it can scarce be distinguished; and at others on the contrary, undoubtedly in Flötz Rocks with impressions of petrifications belonging to both organized kingdoms, as of plants, near Saarbruck, and of animals (Trilobite,) near Andrarum, in Sweden.

31. Slate. Schist. *Ger. Thonschiefer. Layenstein. Wacke. Fr. Ardoise.*

Grey, passing through a variety of other colours into black;

sometimes striated, spotted, &c. ; glimmering, sometimes with silky lustre ; of very different degrees of fineness of grain ; fracture sometimes straight, sometimes undulated ; fragments sometimes disk-shaped, at others in thick lamellæ ; rarely trapezoidal ; soft or half hard. Streak greyish-white. In an endless number of Varieties, often named from the uses to which they are applied, as Touch-stone, &c. Passes by numerous transitions into Siliceous Slate, Mica Slate, &c. Occurs chiefly in mountains containing veins ; but sometimes also in Flötz Rocks, as for instance, the Tabular Slate, from the Blattenberg.

Black Chalk. Ger. *Zeichenschiefer*, is a particular Variety, very soft, and soiling the fingers.

32. Whet Slate. Ger. *Wetzschiefer*. Fr. *Pierre à Rasoir*. Generally greenish or yellowish-grey ; sometimes cream-yellow and greyish-black ; a little translucent at the edges only ; faintly glittering ; fracture slaty, sometimes splintery ; half hard ; found in mountains containing veins, in the Levant, and in Germany. (Bayreuth.)

33. Clinkstone. Ger. *Klingstein*. Phonolite. Grey, in a variety of shades, especially green ; with a dull lustre ; translucent at the edges ; thick slaty structure ; fracture coarse splintery ; half hard ; tough. Specific gravity 2575. Contents, Alumina 23.5 ; Silex 57.25 ; Lime 2.75 ; Oxyde of Iron 3.25 ; Oxyde of Manganese 0.25 ; Soda 8.1 ; Water 3. (KLAPROTH.) Its name is derived from the ringing of layers of it when struck. It forms the ordinary basis of Porphyry Slate. Found, among other places, in Bohemia and Lusatia.

34. Trap. Whinstone. Ger. *Trapp*. Wacke.—*Saxum trapezium*. LINN. *Corneus trapezius*. WALLER. Generally greyish-black, but passing also into greenish and red-brown ; not transparent ; fracture dull, fine granular, sometimes earthy ; amorphous ; hardness and specific gravity various. It frequently forms the principal part of a compound Porphyry-like rock, with a mixture of other fossils, as Basaltic Hornblende, Mica, Zeolite, Chalcedony, Calcareous Spar, &c. To the same class belong most Amygdaloids, as for instance, that from Ilfeld, the Pearlstone from Lerbach in the Hartz, and the Toadstone from Derbyshire. It passes into greenstone, Basalt, &c. It is one of the rocks most extensively diffused into the most remote regions, viz. to the north, as far as

Iceland, Kamtschatka, &c., and in Kerguelen's Land, the most southerly of European discoveries.

Here also probably belong,

(a.) Many kinds of *Compact Lava* from Vesuvius.

Generally brown-red ; intermixed with small grains of black or green Basaltic Hornblende and Calcareous Spar. It appears to be the primitive form of many of the Lavas of Vesuvius, among which it is commonly but erroneously reckoned : and

(b.) Variolite.

Dark leek-green, intermixed with pale mountain-green spots, which give the stone a pocky appearance. Found chiefly in Bayreuth, and as rolled masses in the Durance, near Briançon.

35. Basalt. *Ger.* Basalt. Beilstein.

From black into greyish, bluish, and greenish ; of very irregular grain ; more or less dense ; sometimes in rough, slaty exfoliations, sometimes in rounded grains agglutinated together. Generally either amorphous or prismatic. The prisms, with from three to nine sides, stand sometimes in thousands close together ; generally oblique and inclined, but sometimes perpendicular ; sometimes curved ; sometimes regularly articulated*, and the joints occasionally rounded by disintegration. Hardness and specific gravity very various ; sometimes powerfully magnetic. Contents of a Bohemian prismatic Basalt, Alumina 16.75 ; Silex 44.5 ; Lime 9.5 ; Magnesia 2.25 ; Oxyde of Iron 20 ; Oxyde of Manganese 0.12 ; Soda 2.6 ; Water 2. (KLAPROTH.) It commonly contains one or more Species of other Fossils, particularly Olivine, Augite, Steatite, Felspar, Zeolite, Basaltic Hornblende, &c. It passes particularly into Trap, Tuffwacke, and Lava ; and occasionally into Greenstone, a compound of Hornblende and Felspar. *Fr.* Roche Amphibolique†. It is commonly found in single hills, but occasionally forms entire chains of mountains.

* As is particularly the case in the countless large Basaltic prisms composing the Giant's Causeway on the North Coast of Ireland, one of the most prodigious phenomena in physical science. I have in my possession four joints of this celebrated Basalt, weighing together upwards of 400 pounds, and of which I have given a correct representation in my *Abbild. Nat. Hist. Gegenst.* Tab. 18. The very regular articulation of these prisms still remains one of the most obscure and remarkable circumstances in Geogeny.

† Most of the ancient Egyptian Basalts appear to be of this kind. In many of the Varieties, particularly the black, the component parts may be distinguished, forming a transition into the Semi-granite composed of Hornblende and Felspar. I have said more on this subject in my *Specimen Historiæ naturalis antiquæ artis operibus illustratæ*. p. 29.

Both Basalt and Trap, which belong to the most extensively diffused Flötz Rocks of the primitive world, are easily affected by heat ; and as we now perceive the traces of many subterraneous combustions subsequent to the formation of our Planet, it is easy to understand how they have acted in many places, and particularly on these fusible substances, leaving after them the most convincing proofs of the changes they have produced.

36. Tuffwacke. *Ital. Tufa.*

Generally ash-grey, sometimes yellowish, red-brown, &c. ; fracture earthy ; consistence various ; light ; generally of volcanic origin. Hence usually found near volcanos.

The numerous Varieties may be included under the two following kinds, which, however, occasionally pass one into the other :—

(1.) *Spongy Tuffwacke.*

Structure cellular, vesicular, more or less loose or compact, and of different degrees of consistence.—Of the looser kind are the reddish-brown intermixed with Leucite, of which Pompeii was principally built ; and that containing Hornblende, and in the country about Andernach, interposed between the Tarras and the Rhenish Mill-stone. Of the more compact kind, on the contrary, are the ash-grey *Piperno* of the *Campi Phlegræi* containing much Felspar, and most of that containing Olivine, from the Hawk's Wood, a little distance from Cassel.

(2.) *Earthy Tuffwacke.*

Here belong the two Varieties remarkable for their utility in building under water :—

(a.) *Pozzuolana. Pulvis puteolanus. VITRUV.*

Ash-grey ; sometimes powdery, sometimes in fragments. Found particularly near Pozzuoli. It appears to be the principal ingredient in FAXE's Stone Paper.

(b.) *Tarras. Terras. Ger. Trass.*

Yellowish-grey ; generally contains fragments of Pumice, and occasionally branches or twigs of carbonized wood*. Found particularly near Andernach, on the Rhine.

37. Lava and Scorix. Scoria Vulcani.

Including the Fossils, sometimes scorified, sometimes vitrified, principally of Basaltic origin, produced by the effects of sub-

* As is also sometimes found in the *Piperno*.—See Sir W. HAMILTON's *Campi Phlegræi*. Tab. 40. No. 3.

terraneous fires ; viz. in Volcanos, Lava, and from other subterraneous combustions, Scorix*.

They are generally black, but sometimes also grey, reddish-brown, &c. ; translucent in small splinters only ; very various in specific gravity ; composition, according to the nature of the primitive Fossils of which they are formed, and also with respect to the degree and duration of the temperature to which they have been exposed. Lavas, as well as Basalt and Tuffwacke, often inclose Basaltic Hornblende, Olivine Leucite, &c.

They (Lavas) may be arranged under the following heads :—

(1.) *Scoriaceous Lavas*. Ger. *Schlackenartige Laven*.

The most common generally iron-black, with a dull lustre on the fracture ; heavy ; often fusiform, drop-shaped, branched, in various ways†. Among these the Rhenish Millstone, from the country about Andernach, deserves notice.

(2.) *Vitreous Lavas*. Ger. *Glasartige Laven*.

Smoke-grey, black, brown, &c. ; generally with vitreous lustre and conchoidal fracture ; many resemble Obsidian, others Pitchstone. Found particularly on the Lipari Islands, on the newly formed Volcanic ones near Santorini, on Ascension, in the Atlantic Ocean, and Easter Island, in the South Sea.

VI. MAGNESIA.

Magnesia; the distinguishing qualities of which were first ascertained by Professor BLACK, precipitates all other Earths from their solutions in Acids ; is easily soluble in, and imparts a bitter taste to them. It turns vegetable colours green. It nearly resembles Alumina in the effects produced upon it by fire.

It is remarkable that green is the predominant colour in most of the minerals included in this Genus. They are generally greasy to the touch. Most of them are uncrystallized, and they are found only in rocks containing veins, and consequently do not contain petrifications.

1. Chlorite.

* See R. W. NOSE's *Beyträge zu den Vorstellungen über vulcanische Gegenstände*. Frankf. 1792-4. Th. 3. 8vo.

† Of those from Vesuvius, the rope-shaped, spirally twisted of the *Atrio di Cavallo*, and the oval *Bombe*, ejected in the great eruption of 1790, deserve mention.—See the *Campi Phlegræi*. Tab. 13 and 33 ;—and the *Supplement*. Tab. 4.

Mountain-green, leek-green, &c. ; not transparent ; faint glittering lustre ; sometimes scaly ; soft ; emits the argillaceous odour when breathed on.

The Species includes three Varieties :—

(1.) *Earthy Chlorite*. Ger. *Chloriterde*. *Sammeterde*.

Powdery or loosely aggregated ; glimmering ; not soiling the fingers ; meagre to the touch. Contents, Magnesia 8 ; Silic 26 ; Alumina 18.5 ; Oxyde of Iron 43. (VAUQUELIN.) Found in and about Rock Crystal, particularly in Madagascar and on St. Gothard.

(2.) *Compact Chlorite*. Ger. *Verhüttete Chloriterde*.

With greasy lustre and fine earthy fracture, sometimes lamellar or curved-slaty. Generally as a coating on a variety of crystallized Fossils, as Garnet, Rock-crystal, Magnetic Oxyde of Iron, Bitterspar, &c.

(3.) *Chlorite Slate*. Ger. *Chloritschiefer*.

Blackish-green ; lustre greasy ; slaty ; streak greenish-grey ; often incloses Garnets, columnar Schorl, &c. Passes into Clay Slate, Mica Slate, &c. Found in the Tyrol, Norway, and Corsica.

Many of the Sectile Stones (so called) belong here, others to the following Species ; and others again to Mica Slate.

2. Potstone. Ger. *Topfstein*. *Weichstein*. Fr. *Pierre ollaire*.

—*Lapis ollaris*.

Generally greenish-grey ; not transparent ; fracture earthy, sometimes faintly glimmering ; greasy to the touch ; structure almost lamellar ; soft. Specific gravity of a specimen from New Caledonia, 2622. L. Contents, Magnesia 38.54 ; Silic 38.12 ; Alumina 6.66 ; Oxyde of Iron 12.2. (WIEGLEB.) Found particularly in the Grisons and Greenland. Used for kettles, pots, lamps ; in New Caledonia for stones for slings ; where also a softer and more friable Variety is eaten in large quantities by the natives.

The Giltstein, from St. Gothard, has a coarser grain, and a more splintery fracture ; it is more brittle, and is cut in large tabular masses for the purpose of making (indestructible) stoves.

3. Talc. Ger. *Talk*.

Commonly silver-white passing into pale apple-green ; slightly translucent ; with shining lustre ; greasy to the touch.

There are three kinds :—

(1.) *Earthy Talc*.

In small scales; detached or coherent, and in the latter case friable; soiling the fingers. Found, among other places, in Greenland.

(2.) *Common Talc.*—*Talcum Venetum*.

In various shades of green; generally with nacreous lustre; with curved lamellæ; flexible. Specific gravity 2780. Contents of that from St. Gothard, Magnesia 30.5; Silica 62; Oxide of Iron 2.5; Potash 2.75; Water 0.5. (KLAPROTH.) Passes into Potstone, &c.

(3.) *Talc Slate.* Ger. *Talkschiefer*.

Generally greenish-grey; with greasy lustre; slaty; often intermixed with Iron Pyrites. Passes into Chlorite-slate.

4. *Magnesite.*

From chalk-white to greyish or yellowish; not transparent; generally with a flat, conchoidal fracture; half-hard; meagre; soils the fingers; adheres to the tongue; generally in globular aggregated masses. Contents, Magnesia 48; Carbonic Acid 49; Water 3; (KLAPROTH.) Found, among other places, in Styria and the county of Durham.

5. *Meerschaum.* (*Sea-foam.*) *Spuma Marina.* *Leucaphrum*.

Fr. *Ecume de Mer.* Turk. Kefekil or Killkessi, (*i.e.* *Foam or Light-clay.*)

Generally pale cream-yellow; fracture dull, fine-earthly; greasy to the touch; gives a glittering streak; very soft; and very light. Contents, Magnesia 17.25; Silica 50.5; Water 25; Carbonic Acid 5. (KLAPROTH.) Found principally at Kiltischik, (*i.e.* *place of clay,*) near Conia in Anatolia*.

6. *Steatite.* Ger. *Speckstein.* Fr. *Pierre de Lard.*—*Steatites*.

In a variety of colours, mostly pale; sometimes marbled, or with dendritical marks; a little translucent at the angles; lustre dull-greasy; greasy to the touch; fracture short-splintery; generally amorphous; that from Bayreuth rarely in small crystals, and then in six-sided prisms with similar terminal pyramids, (Tab. 2. fig. 19.) also rhomboidal, &c.; soft in different degrees, but hardens in the fire so as to give sparks with steel†. Specific gravity of a specimen from the principality of Bayreuth, 2614. Contents, Magnesia 30.5; Silica

* See BECKMANN in *Comm. Soc. Reg. Scient.* Götting., Vol. IV. p. 46. —R. REINEGG's *Letter from Persia* to BARON VON ASCH, in VOIGT's *Magazine*. Vol. IV. pp. 3-13.

† On the utility of the Steatite in Manufactures, &c. See *Der Steinschneider von C. v. DALBERG*. Erfurt, 1800. 8vo.

59.5; Oxyde of Iron 2.5; Water 5.5. (KLAPROTH.) To the softer Varieties belong the Spanish and Briançon Chalks.

7. Soapstone. *Ger.* Seifenstein.—*Smectis.*

Sometimes milk-white and translucent at the edges, sometimes yellowish, blackish-grey, &c.; silky to the touch; sometimes lamellar; easily scratched with the nail, and may be cut like soap. Contents, Magnesia 24.75; Silex 45; Alumina 9.25; Oxyde of Iron 1; Potash 0.75; Water 18. (KLAPROTH.) Found in Cornwall. Used particularly in the manufacture of the English Staffordshire ware.

8. Serpentine. *Ital.* Gabbro.

In a variety of colours, chiefly black or greenish-grey, sometimes dark-red, &c.; veined, marbled, spotted, &c.; for the most part translucent at the angles only; small splintery; greasy to the touch; sometimes capable of taking a polish. Mean specific gravity 2700. Contents, Magnesia 44; Silex 44; Alumina 2; Oxyde of Iron 7.3; Oxyde of Manganese 1.5; Oxyde of Chrome 2. (VAUQUELIN.) It occasionally contains Pyrope intermixed. Found particularly at Zöblitz, in the Erzgebirge, in Bayreuth and Sörmeland. The serpentine rock discovered by AL. HUMBOLDT, near Erbdorf, on the Fichtelberg, is particularly worthy of notice, many parts of it, even in small fragments, evincing considerable polarity.

WERNER gave the name of Noble Serpentine to a Variety resembling Jade, generally of a dark leek-green colour, transparent, and somewhat harder than the common, and found intermixed in many kinds of Italian marbles; for instance, in one kind of *Verde Antico*, and in the *Polzevera*.

9. Jade. Nephrite. *Ger.* Nierenstein.

Chiefly leek-green in many shades, on the one hand passing into light mountain-green, and on the other into black-green, (as in the antique Egyptian, known by the name of *Pietra d'Egitto*, of which the specific gravity is 2655. L.); more or less translucent; with greasy lustre; fracture splintery; of various degrees of hardness; generally susceptible of polish.

A particular and remarkable Variety is the Punammu-stone (Axe-stone); leek-green in a variety of shades; giving sparks with steel. Specific gravity 3000. L. Found in particular on Tavai-Punammu, the most southerly of the Islands of New Zealand, where it is manufactured by our Antipodes into hooks, chisels, ear-rings, &c. (but not into axes.)

To this Species also belongs the celebrated Chinese Stone, *Yeu*; it is whey-coloured, and consequently but slightly translucent; lustre greasy; and scratches glass. It is used for making seals, &c.

10. Chrysolite. Peridote.

Generally pistachio-green; transparent; with vitreous lustre; fracture conchoidal; crystallized in broad quadrangular prisms having the lateral edges truncated, and generally terminated by six-sided pyramids. Mean specific gravity 3375. Contents, Magnesia 43.5; Silex 39; Oxyde of Iron 19. (KLAPROTH.) Its locality is not exactly known, but is probably in Turkish Asia.

11. Olivine. *Ger.* Basaltischer Chrysolith.

Olive-green in many shades; when disintegrated it becomes ochre-yellow; translucent; with vitreous lustre; fracture conchoidal, sometimes lamellar; fissured; intermingled in Trap, Basalt and Tuffwacke. Specific gravity 3225. Contents, Magnesia 38.5; Silex 50; Lime 0.25; Oxyde of Iron 12.5. (KLAPROTH.)

Similar to it, as well in external characters as in composition, is the remarkable Fossil, occupying the interstices of the celebrated mass of iron, re-discovered by PALLAS in 1772, on the banks of the Jenisei, and composed, according to HOWARD, of Magnesia 27; Silex 54; Oxyde of Iron 17; and Oxyde of Nickel 1.

There is also a coincidence in composition with the *Aërolites* or *Meteoric Stones*, which have fallen at various times in different parts of the world, but all under the same circumstances, viz. the explosion of a Meteor; and of which, those that have been accurately examined, agree remarkably both in their contents and external characters, whilst they differ most decidedly from all known earthy Fossils.

12. Asbestos.

whitish, yellowish, greenish, &c.; amorphous; of fibrous or lamellar structure. The four following kinds are distinguished:

(1.) *Amianthus*. *Ger.* *Bergflachs*.

Generally greenish; white; slightly translucent; with a considerable glimmering and sometimes silky lustre; in delicate fibres often some inches long; elastic and flexible. Contents of a Swedish specimen, Magnesia 17.2; Silex 64; Lime 13.9; Alumina 2.7; Oxyde of Iron 1.2. (BERGMANN.) Found in the

Grisons, in Corsica, and in great abundance in China, where it is commonly used for lamp-wicks.

(2.) *Common Asbestus.*

Generally inclining to leek-green; slightly translucent; with vitreous lustre; in long splintery fragments; not flexible. Contents, Magnesia 48.45; Silix 46.66; Oxyde of Iron 4.79. (WIEGLEB.): often found in and near Serpentine.

(3.) *Mountain Cork. Mountain Leather.* Ger. *Bergkork. Bergleder.*

Generally passing into cream-yellow; not transparent; sometimes lamellar, sometimes compact; the fracture sometimes with interlaced fibres; very soft; elastic and flexible. Mean specific gravity 0.836. Contents, Magnesia 26.1; Silix 56.2; Lime 12.7; Alumina 2; Oxyde of Iron 3. (BERGMANN.) Found, among other places, in large masses near Dannemora, in Upland, (Sweden), and in the Government of Olonetzsk*.

(4.) *Mountain Wood.* Ger. *Bergholz. Holzasbest.*

Wood-brown, passing into grey, &c.; not transparent; lustre dull glimmering; structure perfectly ligneous; soft; adheres to the tongue; somewhat flexible; gives a glittering streak. This Fossil, in many respects but imperfectly known, occurs at Sterzingen, in the Tyrol.

13. *Actinolite. Actinote.* Ger. *Strahlstein.*

Generally mountain or olive-green, sometimes passing into grey; more or less translucent; fibrous or radiated. There are three kinds.

(1.) *Common Actinolite.* Swed. *Hornblenda.*

In various shades of green; translucent; with shining lustre; striated longitudinally; structure sometimes direct, sometimes radiated divergent; generally crystallized in long, flattened, sometimes needle-shaped, four or six-sided prisms; semi-hard. Specific gravity 3250. Contents, Magnesia 20; Silix 64; Lime 9.3; Alumina 2.7; Oxyde of Iron 4. (BERGMANN.) It has been already mentioned (p. 307.) that Prase consists of Quartz intermixed with this kind of Actinolite.

(2.) *Asbestiform Actinolite.* Ger. *Asbestartiger Strahlstein.*

Greenish, greyish, &c.; very slightly translucent; with a dull glimmering lustre; generally fibrous divergent; amorphous;

* Among the specimens presented to the Göttingen University Museum, by the BARON VON ASCH, is one, in which this substance serves as matrix to large grains of dendritic native Copper.

soft; somewhat greasy to the touch. Passes into Asbestos. Found, among other places, in the Fichtelberg.

(3.) *Glassy Actinolite*. Ger. *Glasartiger Strahlstein*. *Glasamiant*. Generally greenish-white; translucent; with vitreous lustre; generally of fibrous structure; very brittle. Contents, Magnesia 12.7; Silix 72; Alumina 2; Lime 6; Oxyde of Iron 7.3; (BERGMANN.) Found, among other places, in the Zillerthal.

14. Sahlite. Malacolite.

Greenish-grey passing into light leek-green; translucent at the edges; lustre almost waxy; sometimes amorphous, sometimes crystallized, and then chiefly in four-sided prisms with the angles truncated. Specific gravity 3236. Contents, Magnesia 19; Silix 53; Lime 20; Alumina 3; Oxydes of Iron and Manganese 4; (VAUQUELIN.) Found at Arendal, (Norway).

Similar to this is the Baikalite; olive-green in a variety of shades; slightly translucent; with vitreous lustre; the longitudinal fracture lamellar with cleavage in one direction; the cross fracture conchoidal; generally crystallized in four-sided prisms with the angles replaced; the crystals sometimes very large. Specific gravity 2200. Contents, Magnesia 30; Silix 44, Lime 20; Oxyde of Iron 6. (LOWITZ.) It occurs between Calcareous Spar and Mica in large lamellæ, at the sources of the Sliudenska, to the S. W. of the Baikal Lake.

15. Tremolite. Grammatite.

White in many shades; more or less translucent; structure radiated or fibrous, sometimes lamellar; generally divergent; it generally occurs in a matrix of white granular, sometimes sandy, Carbonate of Lime. (Dolomite.) There are three kinds.

(1.) *Common Tremolite*.

Generally greyish-white, sometimes snow-white; but little translucent; generally with silky lustre; sometimes with curved fibres; generally amorphous, but sometimes crystallized in very oblique four or six-sided prisms, generally with transverse fissures; rarely star-shaped. Contents, Magnesia 14; Silix 60.5; Lime 23.25. (LOWITZ.) It gives a phosphorescent streak when scratched with the nail in the dark. Found in particular in the Levantinerthal, on St Gothard.

(2.) *Talciform Tremolite*.

Silver-white; with nacreous lustre; almost untransparent; sometimes lamellar; greasy to the touch; staining the fingers silver-white; soft; phosphorescent like the kind above, by the

disintegration of which it may be produced. Also found on Mount St. Gothard.

(3.) *Glassy Tremolite.*

Greyish and yellowish-white; translucent; with vitreous lustre; lamellar; the longitudinal fracture fibrous or splintery; very brittle; hard; very strongly phosphorescent in the manner above mentioned. Found, among other places, in Ceylon*.

16. Boracite. Borate of Magnesia.

This Fossil, so remarkable in every respect, is rarely found colourless and limpid; it is generally white, sometimes smoke-grey, and more or less translucent; when recent its lustre is vitreous, but by exposure to the air becomes rough and dull; fracture conchoidal; always crystallized, and properly as a cube, of which the angles and corners are truncated, so that the planes substituted for the latter, are alternately hexagonal and triangular, and that the whole crystal is bounded by twenty-six planes. (Tab. 2. fig. 3.) When recent it is hard. Specific gravity 2566. Contents, Magnesia 13.5; Boracic Acid 68; Lime 11; Alumina 1; Silex 2; Oxyde of Iron 0.75. (WESTRUMB.) According to VAUQUELIN, Lime is found only in the opaque, and not in the transparent Boracite. In an elevated temperature it displays the electricity of Tourmaline, but with four Axes, of which each is directed from one of the hexagonal planes replacing a solid angle of the cube to the opposite and corresponding triangular plane, the former extremity of the axis being positively, and the latter negatively electric. This Fossil, so unique in its kind, is found in the lamellar Gypsum of the Kalkberg, near Lunenburg, and often accompanied by small and very perfect crystals of brown Quartz.

VII. LIME.

Calcareous Earth (quick, caustic, or unslacked Lime,) has a caustic taste, and becomes hot by the addition of water. Alone, it is infusible, but is easily fused when mixed with other substances, particularly Silex and Alumina. It has a great affinity for Carbonic Acid; it combines with Sulphuric Acid and forms Gypsum; with Fluoric Acid, forming Fluor-Spar, &c.; and changes blue vegetable colours to green.

* A specimen presented to me by Sir J. BANKS, and which had belonged to Dr. KÖNIG, was collected by the latter near Gallo, in the Island of Ceylon.

The Fossils belonging to this Genus are sometimes soft *, and for the most part, only semi-hard ; they become brittle when burned ; are for the most part of animal origin ; and form one of the most extensive Genera.

The various Species are arranged in the most natural way, according to their combinations with different acids.

(A.) Carbonates of Lime.

1. Calcareous Spar†. *Ger. Kalkspath.*

Sometimes colourless and limpid, but mostly white ; rarely coloured ; more or less transparent ; with considerable lustre ; it has a rhomboidal texture, and large clear fragments, show a considerable degree of double refraction ‡, whence the name of Double Refractive Spar, (*Spathum disdiaclasticum*,) Iceland Spar, as it was formerly, but erroneously called ; it is sometimes found amorphous, sometimes stalactitic ; sometimes columnar and aggregated ; most commonly however, crystallized, particularly in six-sided prisms (Tab. 2. fig. 10.) variously terminated ; sometimes by three-sided obtuse-angled pyramids (Tab. 2. fig. 11.) ; or in six-sided tables which sometimes pass into the prisms ; or in single or double three-sided pyramids (Tab. 2. fig. 1.), the latter so much flattened as to be lentiform ; sometimes in rhombs ; sometimes in six-sided pyramids. Specific gravity 2751. Contents, Lime 56.15 ; Carbonic Acid 43.7. (STROMEYER.) Passes into granular Limestone, brown Spar, &c.

To this head also belongs the crystallized Sandstone (*Grès cristallisé*), as it is improperly called, from Fontainbleau. It is yellowish-grey ; translucent in splinters only ; internally with a dull glimmering lustre ; without any evident sparry structure ; with a splintery fracture ; in rhomboidal crystals with rough external surfaces. Specific gravity 2611.

2. Arragonite.

Generally greyish-white, passing into bluish ; translucent ; lustre vitreous ; fracture lamellar ; crystallized in six-sided

* But as Alumina is combined in the precious stones so as to give them a remarkable degree of hardness, so also, Lime is sometimes sufficiently hard to give sparks with steel. See LOQUEZ, in *Mem. de l'Acad. de Turin*. T. 5. p. 870. The like is also sometimes the case with the phosphate of lime in the enamel of the teeth of animals.

† *Traité complet de la Chaux carbonatée et de l'Arragonite, par le CTE. DE BOURNON.* Lond. 1808. 3 Vols. 4to.

‡ See NEWTON's *Optice*. p. 271, 356, 376 and 394, of CLARKE's Edition. 1719.

prisms (Tab. 2. fig. 10.), commonly as Twin Crystals, (*Fr. Macle.*) sometimes in several small ones, aggregated in a columnar manner; its structure is concentric to the longitudinal axis. Specific gravity 2778. Contents, Lime 53.62; Strontian 2.31; Carbonic Acid 42.44; Water 0.3. (*STROMEYER.*)* Its name is derived from its locality, where it is found in hollows amongst brick-red Gypsum.

3. Schiefer Spar. Slate Spar. *Ger. Schieferspath.*

Generally snow-white; translucent at the edges; lustre dull nacreous; fracture lamellar or slaty; amorphous; soft; effervesces violently with acids. Specific gravity 2474. Contents, Lime 55; Oxyde of Manganese 3; Carbonic Acid 41.66. (*BUCHOLZ.*) Found principally at Schwarzenberg, in the Erzgebirge.

4. Pearl Spar. *Ger. Braunspath. Fr. Spath perlé.*

White, passing into a variety of colours, particularly cream-yellow and brown; translucent at the edges only; lustre vitreous; fracture lamellar; commonly in very oblique rhomboidal fragments; mostly amorphous; but sometimes crystallized in small lenses or rhomboids: somewhat harder than calcareous Spar; and effervesces less violently with acids. Specific gravity 2880. L.

5. Bitterspar. *Ger. Bitterspath. Rautenspath.*

Smoke-grey, honey-yellow, tombac-brown, &c.; translucent; lustre vitreous; in rhomboidal crystals, with generally a calcareous coating. Specific gravity 2480. Contents, Carbonate of Lime 52; Carbonate of Magnesia 45; Oxyde of Iron 3. (*KLAPROTH.*) Found particularly in Saltzburg and Stiria, and chiefly in magnesian Sectile Stone.

The Miemite forms a particular Variety; asparagus-green; columnar; in drusy crystals, almost rectangular Tetrahedrons, with the lateral angles truncated. Specific gravity 2880. L. Contents, Lime 33; Magnesia 14.5; Oxyde of Iron 2.5; Carbonic Acid 47.25; Water 2.75. (*KLAPROTH.*) Found near Glücksbrunn, in the Duchy of Gotha.

6. Calc Sinter. Stalactitic Carbonate of Lime. *Ger. Kalksinter.—Tofus calcareus.*

Of a variety of colours, but in most instances only whitish;

* In *Comment. Soc. Reg. Scient. Götting. recent.* Vol. II. 1813.—And J. F. L. HAUSMANN, in *Magazin der Berliner Naturforsch. Gesellsch.* J. 3. Q. 1.

more or less translucent ; sometimes opaque ; deposited from calcareous water * ; the fracture compact, fibrous, or foliated ; and hence three kinds ; which are found, as at Carlsbad, in an infinite variety of colours, marks, &c. ; the two first are known there under the common name of Sprudelstein (Bubble stone), the third as Peastone, Pisolite (Erbsenstein).

(1.) *Compact Calc Sinter.*

Of very unequal grain and firmness ; sometimes susceptible of a polish, like marble † ; but sometimes also earthy, friable ; varying also considerably with regard to its contents. Chiefly in the form of incrustation, being deposited on the sides of cavities in Limestone rocks, or of cisterns, &c., containing calcareous water ‡ ; or covering other extraneous substances ; or disposed in many accidental forms, (as for instance, among the various kinds of *Travertino*, the *Confetto di Tivoli*, as it is called ;) or completely occupying fissures and other cavities, as in the osseous Breccia at Gibraltar, where it cements together the Osteolites and fragments of stones §.

(2.) *Fibrous Calc Sinter.*

Commonly honey-yellow passing into brown ; structure fibrous, either parallel or divergent ; the recent fracture generally glimmering ; most commonly stalactitic ; sometimes in a variety of accidental forms. Found principally in caverns and rock ; as for instance, in the Grotto of Antiparos, in the Woodman's Cæve, in the lower Hartz, &c.

To this head also belongs the exceedingly beautiful, fine-grained *Alabastrites* of the ancients, susceptible of a high polish. (*Ital.* Alabastro antico. *Fr.* Albâtre calcaire ou oriental*.)

The *Flos Ferri*, as it is called, is a remarkable Variety of Coral-shaped Calc Sinter ; of a snow-white colour ; silky lustre on the fracture ; with fibres partly interlaced, partly run-

* “ Tales sunt a quæ qualis est natura terræ per quam fluunt.” PLIN. XIV. 4.

† For which reason the fine-grained Sinter (*Albâtre factice*) deposited at the *Bagni di San Filippo*, near Florence, is used to make marble-like bas-reliefs and medallions. On which subject consult the *Transact. of the Götting. Royal Society*. Vol. I. p. 94. (in German.)

‡ As for instance in the celebrated *piscina mirabile*. See p. 1.

§ Consult the section on Petrifications on the Guadeloupe Sinter (Galib; Stone), in which human bones were found imbedded.

* On the celebrated Alabaster at Tabriz, in Persia, and its formation, see J. MORIER'S *Second Journey through Persia*. Lond. 1818. 4to. p. 284.

ning in a curved direction; and in form, branchy, angular. It is found particularly on the walls of the Treasury, in the Arzberg, at Eisenerz, in Stiria, in Brown Spar. (Spathose Iron.)

(3.) *Foliated Calc Sinter.*

Generally chalk-white; in layers; sometimes as an incrustation either in curved or wave-shaped layers; but more commonly as a covering to grains of sand, as for instance, the *Dragées de Radicofani*.

Of this kind is the before-mentioned Carlsbad Peastone, which is often concreted into masses, is sometimes susceptible of polish, and must not be confounded with the Roestone afterwards treated of.

7. Agaric Mineral. *Ger.* Mondmilch.—*Lac Lunæ*, Morochthus.

White; fine earthy, like starchy chalk; soiling the fingers; meagre to the touch; very light. Found, among other places, in the Moon's Cave, on Mount Pilatus, Canton of Lucerne.

The powdery Aphite (Foam Earth) from Rubitz, near Gera, is a particular Variety distinguished by its talcy appearance and a peculiar dull silvery lustre. LIPPERT employed it for his impressions from engraved stones.

8. Chalk. *Ger.* Kreide. *Fr.* Craie.

Fine earthy; soft, but firmer than Agaric Mineral; soiling the fingers; adhering to the tongue. Mean specific gravity 2525. Contains 43 per Cent. of Carbonic Acid. It often contains Flint and petrifications of marine animals of the former world; it sometimes forms entire Flötz mountains, particularly on sea coasts; (whence Albion and Creta or Candia have received their names.)

9. Limestone and Marble.

In a variety of colours and formations; generally but little or not at all translucent; always amorphous; generally susceptible of polish, for which reason the finer kinds have received the name of Marble.

Divided into three Varieties, according to the fineness of the grain:—

(1.) *Granular Limestone, saline or Glance Marble.* *Fr.* *Marbre saccharoide.*

Commonly white (sometimes splendid snow-white), or only in the paler colours; of one colour only (i. e. not marbled); translucent at the edges at least; the fracture glimmering, sometimes like broken sugar; the grain various, sometimes

scaly, &c. Passing, on the one hand, into amorphous Calcareous Spar; on the other, into Compact Limestone. It very rarely includes petrifications; but the Carrara (Marmor Lunense) occasionally contains limpid Rock Crystals. Used in Statuary and Architecture; particularly the superior kinds of *Bianco antico*, of which the most celebrated is the Parian, translucent, like white wax, and of specific gravity 2837.

(2.) *Fibrous Limestone. Satin Spar.* Ger. *Faseriger Kalkstein.*

Fr. *Chaux carbonatée fibreuse.*

Generally white in a variety of shades; sometimes with silky lustre. Found near Clausthal and Zellerfeld, on the Hartz; and particularly beautiful near Alston-Moor, in Northumberland, where it is made into Ear-rings and similar ornaments.

(3.) *Compact Limestone (and Marble).*

As common Limestone, generally grey in a variety of shades; on the other hand, as fine-grained Marble, susceptible of polish, as well in a variety of single colours, as variegated in an infinity of ways, marbled, veined, &c., in endless variety. Thus of single-coloured marbles, the admirable antique kinds, *giallo, rosso, nero*, &c.; in two colours, the *pavanazzo*, white, with red streaks; with three colours, the *florito*, white, red, and yellow; with four, the *broccatello*, white, red, yellow and grey; &c. Of those with particular marks—Dendritic Marble, (*Algerino*); Ruin Marble, (*Cittadino rudrato, paësino, Rimaggio*, &c.) passing into Marl-stone. Of those which contain foreign bodies, the Shell (*Lumachelli*) Marble, and the Coral Marble, to which belongs the *Pietra stellaria*. Many kinds are Breccia-Marbles, composed of the fragments of various sorts of Marble cemented together. Many kinds are intermixed with Magnesian Fossils; either marbled, as the *Polzevera* (containing Serpentine); or in the form of flame, as the exceedingly beautiful leek-green *Cipollino antico*.

Compact Limestone (and Marble) has in general a splintery fracture; sometimes a slaty structure, (as for instance, in the Calcareous Slate from Pappenheim, recently employed in Lithography, and which presents remarkable impressions of marine animals of the former world.) Its mean specific gravity is 2675. It passes into Marl-stone (as for instance, in the older Flötz Limestone.) It forms large chains of Flötz mountains dispersed through all parts of the world, and containing on their external surface (rarely at any considerable depth,) the

common petrifications of the marine animals of the former world.

Among the most remarkable Varieties of common Limestone are :—

(a.) *The Oolite, Roestone.* Ger. *Rogenstein*—*Hammites*, which must not be confounded with the Pisolite, (Peastone,) and consists of considerable masses, (sometimes forming entire Flötz Strata,) of compact Limestone in grains, of which the lamellæ are rarely concentric, and which are bound together into a solid stone by a calcareous or marly cement. Of this kind are the celebrated English building stones, the Portland, Purbeck, &c.

(b.) Those kinds which in the grain resemble Sandstone ; as is the case, for instance, with the celebrated rock of Petersberg, near Maestricht, famed for its numerous petrifications of marine animals ; the *Marmo arenaceo* from Vesuvius ; the Dolomite, which sometimes is nearly one half formed of Carbonate of Magnesia, found, among other places, in the Levantinerthal, on St. Gothard, where it forms the matrix of Tremolite, and occurs in thin flexible tables.

10. Marl. Ger. *Mergel.* Fr. *Marne*.—*Marga*.

An intimate mixture of Clay, Lime, Sand, &c. Generally grey, passing into many other colours ; not transparent ; of various degrees of consistence and hardness ; hence divided into three principal kinds :—

(1.) *Earthy Marl.*

Loose or aggregated in various degrees ; meagre ; generally rough to the touch ; divisible by stirring in water ; attracts moisture from the air, and falls in pieces sooner or later. The Varieties are named Calcareous Marl, Clay Marl, &c.* from their predominant elements, and employed accordingly for ameliorating various kinds of soil.

(2.) *Marl-tuff.* Ger. *Tuchstein*.

Of loose, pervious, sometimes spongy texture ; fracture generally earthy ; it hardens in the air instead of falling to pieces. Almost always incrusts traces of vegetable remains, particularly impressions of leaves, roots and reeds, the latter tube-shaped ; also in many places, small fresh-water shells ; in others, calcined sea-shells. It occasionally forms extensive

* Of the latter kind is the fertilizing deposit from the Nile, in Lower Egypt.

Strata of low alluvial districts, containing the fossil remains of Elephants, Rhinoceroses, and other tropical land animals, which are now dug up in such abundance in our Zones.

(3.) *Marlstone.*

Compact, and sometimes massive, sometimes slaty; in the latter case often dendritical; also in a variety of forms, as Marl-nuts, &c.; fracture earthy; passes into compact Limestone.

The Sand-marlstone, which becomes phosphorescent by friction, and occurs near Jena, deserves particular notice; as also the *Septaria* (*Ludus Helmontii*) remarkable for their peculiar form; found near Antwerp, and in Franconia, and consisting of cubes of liver-brown Marl-stone, separated from each other by layers of grey compact Calc Sinter, and forming collectively globular compressed masses, sometimes as large as a man's head.

11. Bituminous Marl-slate.

More or less completely impregnated with Bitumen; generally greyish-black; not transparent; glimmering; slaty; very commonly with impressions of fresh-water fishes, as at Riegelsdorf, Eisleber, &c.; sometimes also with impressions of plants, which, however, are totally different from those of the Slate-clay; it more rarely contains unknown marine animals, as for instance, the colossal *Medusa Palm* (*Helmintholithus portentosus*. LINN.) near Boll, in Suabia. It often contains Copper, and is then called Slaty Copper-ore; and sometimes forms considerable strata, which is an object of importance in mining.

12. Stinkstone. Swinestone. *Lapis suillus*.

Generally grey, passing on the one hand into yellowish, on the other into black; commonly opaque, rarely translucent; fracture mostly earthy, sometimes splintery; sometimes like marble, and susceptible of a polish; amorphous, and as well massive as slaty; rarely sparry, as the Stink-spar or Liver-spar from Lisbon. When scraped or scratched it gives the smell of burnt horn. It commonly contains petrifications, as well of unknown marine animals of the primitive world, particularly *Belemnites*, as of organized land and fresh-water objects of both kingdoms, (as in the Stink-slate of Oeningen.)

(B.) *Sulphates of Lime.*

The various Species of this division of the calcareous Genus are in general analogous to those of the former, but *ceteris paribus* much softer.

13. Selenite. *Ger.* Fraueneis. Marienglas. *Ital.* Scagliola.

Sometimes colourless and limpid; but generally whitish, passing into smoke-grey, honey-yellow, &c., and more or less transparent; sometimes with nacreous lustre; structure lamellar; slightly flexible, but not elastic; easily cleaved with the knife; commonly amorphous; but sometimes also crystallized*, principally in the form of a lens, or in rhomboidal tables with the edges replaced, (Tab. 2. fig. 17.); often in twin crystals in various ways; rarely in eight-sided prisms terminated by eight-sided pyramids. Contents, Lime 32; Sulphuric Acid 46; Water 22.

14. Gypsum Sinter.

Like Calc Sinter, deposited in the form of Stalactite or incrustation, sometimes inclosing other bodies; sometimes fibrous, sometimes compact. The latter sometimes resembles Alabaster.

15. Earthy Gypsum. *Ger.* Gypsmehl.

Resembles Agaric Mineral; sometimes snow-white; sometimes greyish, &c.; powdery. Found in clefts, &c.

16. Gypsum.

Generally whitish or greyish, but sometimes also in other colours, commonly faint; more or less translucent; always amorphous.

In three kinds.

(1.) *Foliated Gypsum.*

Generally smoke-grey, sometimes brick-red, &c.; but little translucent; scaly, sometimes lamellar. Specific gravity 2167. Contents, Lime 32; Sulphuric Acid 30; Water 38. (KIRWAN.) Sometimes mixed more or less intimately with other fossils, as for instance, Quartz at Wisbaden, and Hornstone at Montmartre. It sometimes also merely includes other fossils, as for instance, Boracite at Lunenburg, Arragonite and small cinnamon-brown crystals of Quartz, (improperly called Hyacinth of Compostella,) in Arragon.

(2.) *Fibrous Gypsum.*

Generally white; translucent; fibrous on the cross fracture sometimes in a straight, sometimes in a curved direction; commonly glimmering; sometimes with nacreous lustre;

* The Academical Museum of Göttingen contains a step of a miner's ladder, found in a Mine in the Rammelsberg, on the Hartz, which had been abandoned at least 100 years, and on which is deposited a collection of drusy Crystals seven inches in diameter, and of exceeding splendour.

sometimes friable ; found in thin strata ; Specific gravity 2305.

(3.) *Compact Gypsum. Alabaster.*

Sometimes glittering white, but passing through a variety of colours, mostly dull, into black ; sometimes streaked, veined, marbled, &c. ; the white kind sometimes considerably translucent ; dull ; the fracture passing from splintery into earthy.

17. *Anhydrite, Muriacite, Karstenite.*

It includes two kinds of Sulphate of Lime, distinguished in addition to their external characters, by the absence of water of crystallization.

(1.) *Sparry Anhydrite. Cube Spar. Ger. Würfelspath.*

Generally milk-white ; considerably translucent ; with nacreous lustre ; cleavage rectangular in three directions ; very easily broken ; specific gravity 2964. Contents, Lime 40 ; Sulphuric Acid 60. (VAUQUELIN.) Found in the Rock-salt of the Salzburg, and in the Canton of Bern.

(2.) *Compact Anhydrite. Ger. Blauer Gyps.*

Commonly sky-blue, passing into grey, &c. ; but slightly translucent ; brittle ; specific gravity 2940. Contents, Lime 42 ; Sulphuric Acid 57 ; with some Silex and Oxyde of Iron. (KLAPROTH.) Found particularly at Sulz, on the Neckar.

18. *Bituminous Gypsum. Ger. Gypsleberstein.*

It includes Gypsum and Selenite impregnated, like the Stink-stone, with Bitumen, and which, when scraped, emits a smell of Sulphuret of Potash.

(C.) *Fluates of Lime.*

19. *Fluor. Fluor Spar. Ger. Flusspath.*

It has its name from the use to which it is applied in smelting. It is found in most of the colours of precious stones ; rarely colourless ; more or less transparent ; lustre vitreous ; structure sparry ; sometimes amorphous ; rarely aggregated in a columnar manner, as in the *Honey-comb Spar* of Derbyshire ; very commonly crystallized, and principally in cubes ; rarely in double four-sided pyramids (Tab. 2. fig. 5.) ; generally susceptible of polish. Specific gravity of an emerald-green specimen 3481. Contents, Lime 57 ; Fluoric Acid 16 ; Water 27. (KIRWAN.) On red-hot coals it phosphoresces with a green light ; this is particularly the case, (and even in large pieces without crepitating,) in a violet and greenish-white kind from Nertschinsk, called on that account Chlorophane.

Compact Fluor is distinguished by wanting the sparry texture ; it is commonly greenish or bluish-white ; faintly trans-

lucent ; fracture glimmering ; amorphous. Found particularly in Derbyshire, and at Strasberg, in the Hartz.

(D.) *Phosphates of Lime.*

20. Apatite.

Like Fluor in a variety of colours, but paler ; generally transparent ; lustre vitreous ; cross fracture lamellar, longitudinal conchoidal. Usually crystallized, and commonly in six-sided prisms with many Varieties. Specific gravity 3218. Contents, Lime 55 ; Phosphoric Acid with a little Oxyde of Manganese 45. (KLAPROTH.) Phosphoresces on red-hot coals with a green light. Found particularly at the tin works near Ehrenfriedersdorf and Schlackenwald.

The Spanish *Asparagus Stone* and the Norwegian *Moroxite* also belong to this Species.

21. Phosphorite. Earthy Apatite.

Yellowish-white ; opaque ; meagre granular ; fracture earthy and splintery, sometimes passing into fibrous ; semi-hard ; heavy ; when scratched with iron in the dark it gives a vivid streak, and phosphoresces with a green light like Apatite, when placed on hot coals. Found near Truxillo, in Estremadura, in layers alternating with common Quartz ; and loose and powdery near Sigeth, in Hungary.

(E.) *Borate of Lime.*

22. Datolite.

Milk-white ; translucent ; with greasy lustre ; fracture from small conchoidal passing into splintery ; massive and crystallized, apparently in cubes with the edges replaced. Contents, Lime 35.5 ; Silica 36.5 ; Boracic Acid 24 ; Water 4. (KLAPROTH.) Found at Arendal.

VIII. STRONTIAN.

Strontian was first distinguished as an elementary Earth by M. SULZER, of Konneburg, and Dr. CRAWFORD. Among its principal peculiarities are, that it forms acicular crystals with Muratic Acid, and that a solution of this salt in Alcohol burns with a carmine-red flame. Its solution in Nitric Acid gives thick, six-sided, tabular crystals.

This Earth is found combined with two Acids, the Carbonic and Sulphuric.

(A.) *Carbonate of Strontian.*

1. Strontianite.

Generally pale asparagus-green ; sometimes whitish ; translu-

cent ; glimmering ; sometimes with vitreous lustre ; fibrous ; occasionally aggregated in a columnar manner ; commonly in wedge-shaped fragments ; mostly amorphous, and very rarely in distinct acicular crystals. Specific gravity 3591. L. Contents, Strontian 69.5 ; Carbonic Acid 30 ; Water 0.5. (KLAPROTH.) Found in a Lead-vein of the Granite-rock near Strontian, in Scotland, mostly inclosed in Ponderous Spar.

(B.) *Sulphate of Strontian.*

2. Celestine. Schützite.

Not blue merely, as its name denotes, but also white, yellowish, greyish, &c. ; more or less translucent and also opaque ; structure compact, fibrous, or lamellar ; sometimes massive, sometimes crystallized in oblique four-sided tables. Specific gravity of a fibrous specimen from Pennsylvania 3714. L. Contents of the same, Strontian 58 ; Sulphuric Acid 42. (KLAPROTH.) Found, particularly the foliated variety, at Sün-tel near Münder in Hanover, Bristol, Mazarra in Sicily, and the earthy massive kind near Montmartre.

IX. BARYTES.

Barytes (terra ponderosa,) was first distinguished as a peculiar Earth by BERGMANN, and derives its name from its considerable specific gravity, 4000. Like Lime it becomes caustic when burnt ; at an elevated temperature it melts into glass ; with Sulphuric Acid it forms Ponderous Spar ; and is precipitated from its nitric and muriatic solutions by the ley of blood.

Like Strontian it is found combined with the Carbonic and Sulphuric Acids.

(A.) *Carbonate of Barytes.*

1. Witherite.

White, passing into greyish or reddish-yellow ; translucent ; in external character very similar to Alum ; with greasy lustre ; generally amorphous, breaking into wedge-shaped fragments, striated and slightly divergent in the longitudinal fracture ; very rarely crystallized, and then commonly in six-sided prisms with six-sided pyramids. (Tab. 2. fig. 19.) Specific gravity 4271. L. Contents, Barytes 78 ; Carbonic Acid 20. (KIRWAN.) Found principally at the lead works of Anglezark, near Chorley, in Lancashire, and at Steinbauer, in Upper Stiria. It is poisonous to warm-blooded animals, but like other poisons, when properly employed, and in small doses, a serviceable medicine.

(B.) *Sulphates of Barytes.*2. Heavy Spar. Cawk. *Ger. Schwerspath.*

Commonly of sparry texture ; but also, like Selenite, fibrous ; or, like Fluor Spar, compact.

(1.) *Common Heavy Spar.*

Generally white, but also of other colours ; rarely colourless and limpid ; commonly more or less translucent ; sometimes opaque ; usually amorphous ; sometimes in thick lamellar ex-foliations ; but also in a variety of crystalline forms ; as well prisms and tables of four or six sides, and with edges and points of various kinds, as double four-sided pyramids. (Tab. 2. fig. 5.) The prisms are sometimes acicular, as in the Colum-nar Spar of Freyberg. The tables are frequently six-sided with the ends bevelled, the latter again being sometimes brought to a point by small planes. (Tab. 2. fig. 8.) Sometimes in very small tabular crystals, (Capillary Druses) as though strung on thread, or aggregated in a variety of peculiar forms, as for in-stance, like a cock's comb. Specific gravity 4430. Contents of a specimen from Freyberg, Sulphate of Barytes 97.5 ; Sul-phate of Strontian 0.35 ; Silix 0.8 ; Oxyde of Iron 0.7 ; Water 0.7 (KLAPROTH.) Commonly found in veins forming the ma-trix of various ores, but also occasionally in strata.

The Maple Stone. *Ger. Aehrenstein.* Strausasbest, is a white variety of Heavy Spar, grouped like ears of corn, and dispersed through a matrix of ash-grey clay. Found formerly at Osterode.

(2.) *Fibrous Heavy Spar. Bologna Stone.*

Of fibrous structure on the cross fracture ; smoke-grey ; slightly translucent ; in roundish compressed masses, kidney-shaped, and of the form and size of dried figs. Specific gra-vity 4440. Contents, Sulphate of Barytes 62 ; Silix 16 ; Alu-mina 14.75 ; Sulphate of Lime 6 ; Oxyde of Iron 0.25 ; Water 2. (ARVIDSON.) Found only on Mount Paterno, near Bologna. It is from this kind of Heavy Spar that Pyrophori were first made.

(3.) *Compact Heavy Spar.*

Smoke-grey, yellowish, brick-red, &c. ; translucent only at the edges or in splinters ; fracture dull, generally splintery. Contents of that from Rammelsberg, Sulphate of Barytes and Strontian 83.5 ; Silix 6.5 ; Alumina 1.5 ; Sulphate of Lime 2 ; Water and Bitumen 2. (WESTRUMB.) Found in the Rammels-berg, in Derbyshire, &c.

3. Earthy Barytes. Powdery Heavy Spar.

Generally yellowish-grey; earthy; meagre; rough. Found in and near common Heavy Spar.

4. Hepatite. *Ger.* Schwerleberstein.

Sometimes brownish-black, sometimes greyish-yellow; translucent at the edges only, or opaque; glittering; kidney-shaped or in rounded pieces. When shaved or scratched gives out a sulphureous smell. Found principally at Königsberg, in Norway. Contains Sulphate of Barytes 92.75; Coal and Bitumen 2; Sulphate of Lime 2; Oxyde of Iron 1.5; Water 1.25. (JOHN.)

View of the most remarkable kinds of Aggregated or Compound Rocks.

§ 244. We have hitherto considered Earths and Stones as homogeneous and simple Fossils. More commonly however, Fossils of various Species, and even of different Genera, are found combined in the most varied, but at the same time, definite ways, into considerable masses and strata; hence it becomes of the utmost importance to the geognostical part of Mineralogy, to reduce into systematic order the aggregated Rocks composed of heterogeneous Fossils.

§ 245. Here, however, we confine ourselves to those only which, when combined in their definite proportions, compose entire strata; excluding those in which one Fossil is found in another, either rarely or in an isolated manner, as Rock Crystal, for instance, is sometimes found in Carrara Marble; and also those in which Fossils of recent formation are found in holes or drusy cavities of much older Rocks, as for instance, Calc Sinter in old Scoriæ, Lava, &c.

§ 246. The aggregated Rocks, properly so called, may be arranged in three principal Classes, according to the various modes in which their Elements are combined.

(A.) Where the different component parts, at the time of their simultaneous precipitation from the primordial fluid (§ 227.) have crystallized, and become combined without any extraneous cement or matrix, as is the case in Granite; hence pieces of it, when polished, present the appearance of Mosaic.

(B.) Where individual fragments of Fossils are, as it were kneaded into a matrix or mass of another kind of stone, as in Porphyry.

(C.) Lastly, where grains and larger pieces are closely ag-

gregated and agglutinated together by a Cement, as in Breccia and Sandstone.

In the two first Classes, all the component parts are of simultaneous origin. In the third, on the contrary, at least in Brecciæ, the grains and pebbles must have been formed previous to their connexion by a Cement.

§ 227. I have also endeavoured, as far as it is possible, to divide the principal Species into the following Sub-species:—

(a.) *The Genuine or True Species*, containing only the substances properly entering into its composition; as for instance, True Granite containing Felspar, Quartz, and Mica.

(b.) *Spurious Species*, those which, in place of one or others of the elements properly entering into their composition, contain one or others usually foreign to it.

(c.) *Species with excess (of Composition)*, in which, besides their proper components, other bodies, foreign to them and superfluous, are intermixed.

(d.) *Semi Species (imperfect)*, in which one or other of their proper elements are wanting, but without any corresponding addition of foreign substances.

(A.) *Compound Rocks, the Materials of which have simultaneously combined together.*

1. Granite.

Massive in solid Rocks, or stratified in large banks; but of great diversity in the fineness or coarseness of the grain of the mixture, in the relative proportions of the elements, in the greater or less degree of solidity of grain, &c.

(a.) *True Granite*.—*Syenites* *. PLIN.

* The Granite, of which those wonderful monuments of Egyptian art, the Obelisks, were formed, has received this name from the town of Syene, on the Nile, in Upper Egypt. See the *Gabinetto del Collegio Nazareno*. T. 2. p. 238.—“*I graniti delle nostre guglie Egiziane hanno per base un felspato rossigno con quarzo fragile semitrasparente, e mica nero.*”—The specimens of antique Red Granite in my Collection, one from the Obelisk of Rameses, the other from the Column of Antoninus, are precisely similar. Prof. WAD, also, who examined minutely the recent fragments from the celebrated Roman Obelisks, in the Collection of Cardinal BORGIA, says expressly, “*Ex his speciminibus clare patet Syeniten PLINII esse granitem nostrum stricte sic dictum (ex quarzo, feldspato, et mica.)*” See his *Fossilia Ægyptiaca Musei Borgiani*. Velitris, 1794. 4to.—Also W. HAMILTON’S *Ægyptiaca* London, 1809. p. 68. not. †. and DE ROZIERE in the great *Descr. de l’Égypte*. Hist. Nat. T. 2. 1813. p. 45. and T. 3. 1818. p. 461.

As already mentioned, composed of Felspar, Quartz, and Mica only. Such, for instance, is the antique *Granito Rosso*. Such also is the enormous mass, which, though weighing three million pounds, was transported from a morass on the Gulf of Finland to St. Petersburg, in order to form the basis to the statue of PETER the GREAT*.

The celebrated Pe-tun-tse of the Chinese is also a True Granite, the Felspar of which is in a state of disintegration, and forms a principal ingredient in their Porcelain.

(b.) *Spurious Granite.*

That, for instance, which instead of Mica, contains Hornblende, to which head also many antique kinds belong, though not the true Syenite.

(c.) *Superabundant Granite; (with Excess.)*

Which for instance, in addition to Felspar, Quartz, and Mica, contains Hornblende or columnar Schorl, Garnets, Diamond Spar, Magnetic Iron Stone, &c. †

(d.) *Semi Granite.*

Which, for instance, consists only of Hornblende and Felspar, and when they are intimately mixed, passes in an oryctognostic point of view, into Greenstone; or of Felspar and Mica, of which kind may be reckoned the Avanturine Felspar from the White Sea.

2. *Gneiss. Fr. Granit feuilleté.*

The components the same as in Granite, to which it also commonly approximates, and occasionally passes into it, particularly in the kind called by SAUSSURE *Granit veiné*; commonly however foliated, in thick layers, or sometimes even slaty: it is found in mountains containing veins. The Sub-species as in Granite.

3. *Mica Slate. Ger. Glimmerschiefer.*

The components of this Rock are Quartz with Mica in consi-

* The greatest weight that has ever been removed by human means.—The great Obelisk of the Vatican, erected by FONTANA, weighs scarcely one third, only 973,537 pounds.—See Count CARBURY, *Monument élevé à la gloire de PIERRE LE GRAND*. Paris, 1777. fol.

† As is the case, though in small quantity, in a magnetic Granite Rock on the Brocken, in the Hartz, which in certain spots, and even in small pieces, inverts the direction of the Magnetic Needle, like the Serpentine Rock already mentioned as having been discovered by M. HUMBOLDT.—See J. F. L. HAUSMANN, in the Hanoverian Magazine. 1801. p. 84.

derable quantity, and slaty structure. It very commonly contains Ores, and sometimes Alum. Of this kind are,

(a.) *True Mica Slate.*

Often called, from being used to make stoves, *Saxum fornacum*. Ger. *Gestellstein*.—A very beautiful cinnamon-brown kind, gold-glittering like *Avanturine*, is found near *Catharinburg*, in *Siberia*.

(b.) *Superabundant Mica Slate.*

Very commonly containing Garnets. Ger. *Murkstein*.

(B.) *Compound Rocks, in which individual fragments of certain Fossils are as it were inserted or kneaded into a homogeneous Mass or Basis.*

4. *Porphyry. Ital. Porfido.*

The Basis is of various kinds; frequently *Hornstone*, or indurated Clay, or *Trapp*, *Pitchstone*, &c.; like the two preceding kinds, it belongs chiefly to Rocks containing veins, and mostly occurs in solid masses; though sometimes also in a globular form.

(a.) *True Porphyry.*

Feldspar and *Hornblende* intermixed with one of the Bases above-mentioned.

The *Antique Porphyry*, properly so called on account of its beauty, extreme hardness, &c., is, as the name indicates, composed of a red-brown Basis, consisting of a rock of a peculiar kind, like *Hornstone*, and approaching to *Jasper*, containing small fragments of compact *Felspar*, and black *Hornblende* tinged with red by the Basis itself. It is found principally in *Lower Egypt* and *Arabia Petrosa*.

(b.) *Spurious Porphyry.*

Where for instance, besides *Hornblende*, *Calcareous Spar* is intermixed instead of *Felspar*, as in many of the compact *Lavas* (improperly so called) from *Vesuvius*.

(c.) *Superabundant Porphyry.*

With more than two additions to the Basis; of this kind is the *Hungarian Greystone* (*Saxum Metalliferum*, BORN.) consisting of a Basis of indurated Clay, with an intermixture of *Hornblende*, *Felspar*, *Mica*, and sometimes *Quartz*. Found in *Lower Hungary*, where it incloses the principal veins, and forms the matrix of most of the rich Ores of *Gold* and *Silver* existing there*.

* To this Sub-species also belongs the remarkable Rock, out of which,

(d.) Semi Porphyry.

With only one substance added to the Basis. Of this kind is the beautiful Antique Egyptian green Porphyry, (improperly called *Serpentino verde antico*), composed of a leek-green Basis resembling Hornstone, or sometimes Greenstone, with an intermixture of moderately large fragments of Felspar, to which it communicates a pale green colour.

5. Porphyry Slate. Horn Slate.

The Basis of the true Porphyry Slate is commonly the Clinkstone already mentioned. In it are imbedded very small grains of Felspar, Quartz, &c. The structure, as the name indicates, is slaty.

In the White-stone, or Namiesterstein, as it is called from its locality in Moravia, on the contrary, and which also has in general a slaty texture, white compact Felspar forms the Basis, in which are imbedded, after the manner of Porphyry, small Garnets, and sometimes Mica, &c.

*(C.) Compound Rocks, formed by aggregated Grains and Pebbles, agglutinated together by a mere Cement.*6. Breccia. Conglomerate. *Ger.* Trümmerstein.

Irregularly shaped Pebbles and Fragments, imbedded in a Basis often resembling Sandstone. It presents great varieties as well with respect to the Cement as the substances imbedded; the former, however, is always massive, and not of slaty structure.

Among the most remarkable kinds are—

The beautiful and costly antique *Breccia Verde d'Egitto*; the Basis resembling Greenstone, with green compact Felspar, Hornstone, Serpentine, &c.; from which, among other objects of ancient Egyptian art, the celebrated Sarcophagus in the British Museum, known by the name of Alexander, is made.

notwithstanding its extreme hardness, the most prodigious, and, probably, the oldest of all known monuments of human art, viz. the enormous Rock Pagoda, at Elephantia, near Bombay, together with its colossal idols, are, not built, but hewn collectively in the living rock. The specimen which I possess, and which Mr. C. TOWNLEY permitted me to take from the celebrated Groupe in his Collection of Antiquities, consists, as do other Idols from this Temple, which I saw in London, of a basis of very hard liver-brown, ferriferous Clay, in which are intermixed much Felspar, a little Quartz, and still less Hornblende.—See more on this subject in my *Specimen Historiæ Naturalis Archæologicum*, p. 28, &c.

Puddingstone. A Basis of Sandstone generally greyish-yellow, agglutinated by a quartzose Cement, and having firmly imbedded in it rolled masses of Flint, Siliceous Slate, &c.* Found principally in England, and the finest at St. Alban's, Hertfordshire.

The *Rothe todte liegende* of the German Miners. Commonly a Basis of Sandstone agglutinated by a Cement of Clay, containing much Iron, and in which irregularly formed grains of Quartz, Siliceous Slate, &c. are more or less loosely imbedded. It commonly forms the lowest of the Flötz strata in mines; but sometimes entire and considerable mountains, particularly in Switzerland, where the Nagelfluhe is of this kind†.

Greywacke. *Ger.* Grauwanke. *Fr.* Grés gris.

A Basis of Sandstone commonly grey, agglutinated by a Clay Cement, in which are more or less firmly imbedded irregularly shaped Pebbles, or grains of Quartz sometimes of very different sizes. It passes into Sandstone, and particularly into that kind which is found near the strata of Stone Coal, and therefore called Coal Sandstone, in order to distinguish it from the common and more recent Flötz Sandstone. It forms a principal Rock in the Upper Hartz, where it incloses rich mineral veins, and passes into the Flötz Rock.

7. Breccia Slate.

The component parts the same as in the last mentioned kinds of Breccia, but with slaty structure.

So for example Greywacke Slate, which in many parts of the Upper Hartz, as Burgstetterzug, near Clausthal, contains reed-like impressions, which become the more remarkable in Geogeny, as they probably present the earliest traces of organized creation in our Planet.

8. Sandstone.

Quartz in grains commonly of regular shape and closely agglutinated. The Cement is of various kinds; calcareous; or clayey; or ferriferous; and also sometimes even quartzose; in which case, the Sandstone passes into common granular Quartz.

* It appears to be of tolerably recent formation; at least, I possess specimens in which the imbedded masses of Flint contain petrified Cellularia.

† The stratification of the Nagelfluhe mountain-chain is more or less horizontal or depressed; and its Basis of very unequal hardness. The gradual softening of the Clay in a similarly inclined Rock on the Rossberg Mountain, in the Canton of Schwytz, was the cause of its formidable descent on September 2d, 1806, by which the Valley of Goldau was overwhelmed.

(a.) True Sandstone.

Sometimes in large strata; sometimes with crystalline grain; or with impressions of petrifications of organized bodies, (of both kingdoms) belonging to the primitive World.

To Sandstone, with a peculiar form, belongs in particular that which is found near Clausenburg in globular masses of various size.

The crystallized Sandstone (as it is called) of Fontainbleau, has been already mentioned in its proper place (Calcareous Spar.) The kind which occurs in the kingdom of Wirtemberg near Stuttgart, and in Thuringia, is more justly placed here.

(b.) Superabundant Sandstone.

Most commonly containing Mica; but also with many other fossils; for instance with small cubes of brown Iron Ore in the singular matrix of the Red Lead Ore, from Beresofsk, near Catharinburg.

Here also may be placed the Topaz Rock of the Schneckenstein, in Voigtland, which appears to consist of Sandstone passing into granular Quartz, and traversed by acicular black columnar Schorl, common compact Quartz, and sometimes also amorphous Topaz, and yellow Lithomarge.

9. Sandstone Ste.

With regard to structure, it bears the same relation to massive Sandstone, that Porphyry Slate does to Porphyry, or Greywacke Slate to Greywacke, &c.

The flexible Sandstone from *Villa Rica* in the Brazilian province of *Minas Geraes*, which has again* become celebrated within the last forty years, is particularly remarkable. No apparent Cement can be detected between its singular flat-splintery grains.

The true Sandstone Slate has commonly intermixed with it Mica, by which it is also generally traversed on its slaty fracture, as in the English *Yorkstone*, *Bremingstone*, &c. The proportion of Quartz to Mica, however, varies considerably as well with regard to the quantity as to the distribution.

* For it was already known in Europe in the first half of the Seventeenth Century.—See GASSENDI *vit.* PEIRESKII *ad A.* 1650. p. 150.

SECT. XIII.

OF MINERAL SALTS.

§ 248. Salts in general are distinguished from all other bodies, principally by their ready solubility in water; by their specific taste; and by their great affinity or tendency to combine with other substances.

§ 249. All Mineral Salts, (i. e. all those which are found fossil in nature,) belong to the Class of what are called Neutral Salts; that is consisting of an Acid, combined with (A) an Alkali; or (B) an Earth, called on account of this faculty of combination, alkaline; or (C) Metallic Oxydes.

Remark. In point of fact, Gypsum and other Fossils composed of an Acid combined with an Alkaline Earth, belong to the Class of Salts; on account of their want of taste and less perfect solubility, they are, however, at least in mineralogy, more conveniently placed among Earths and Stones.

§ 250. The Mineral Salts are most naturally arranged in the following five Genera, according to the different Acids contained in them:—

- | | |
|----------------------|---------------------|
| I. Muriatic Salts. | IV. Boracic Salts : |
| II. Sulphuric Salts. | AND |
| III. Nitric Salts. | V. Carbonic Salts. |

I. Salts of Muriatic Acid.

1. Rock Salt. Muriate of Soda. *Sal ammoniacum vet.* Sometimes colourless and limpid; more commonly greyish; rarely brick-red, sapphire-blue, &c.; generally more or less translucent; sometimes only glimmering, at others with glittering lustre; the fracture sometimes compact, at others foliated, fibrous or granular; generally amorphous; rarely crystallized, and then in cubes; occasionally including drops of water, &c. Specific gravity 2143. Contents, Muriatic Acid 33; Soda 50; Water 17. Crepitates in the fire. It sometimes

forms considerable strata and masses*, (Salt-pits,) as for instance at Bochnia, and Wieliczka, near Cracow. Sometimes, also, deposited in the form of a firm crust on the shores of salt lakes, as for instance, in Egypt, and the Baikal Lake.

2. Native Sal Ammoniac. Muriate of Ammonia.

White, greyish, &c.; sometimes yellow from an admixture of Sulphur, &c. Commonly dull glimmering; sometimes mealy; sometimes in small indistinct crystals; gives some signs of ductility and elasticity. Specific gravity 1420. Taste cooling, penetrating, alkaline. On hot coals it sublimes in a white vapour. Found chiefly in volcanic districts.

II. Salts of Sulphuric Acid.

(A.) In combination with Alkalies.

1. Native Glauber's Salts. Sulphate of Soda.

Whitish; sometimes translucent, sometimes earthy. Contents, Sulphuric Acid 27; Soda 15; Water 58. Taste bitter, salt, cooling. Found, among other places, near the native Soda of Debresin.

2. Polyhalite. Sulphate of Potash.

This Fossil, formerly classed with Gypsum, then with Anhydrite, and first accurately examined by STROMEYER, is brick-red; lustre waxy; sometimes fibrous; translucent; taste salt, bitter; melts very readily. Contents, Sulphate of Potash 27.48; Sulphate of Lime 51.1; Sulphate of Magnesia 20.11. Found in the Rock-salt at Ischel, in Upper Austria †.

(B.) In combination with alkaline Earths.

3. Native Sulphate of Magnesia.

Generally whitish; translucent; commonly in acicular aggregated crystals. Contents, Sulphuric Acid 33; Magnesia 19; Water 48. Taste very bitter. Found, among other places, near Jena.

The Capillary salt of Idria (Halotrichum), is a particular Variety, distinguished by its long capillary crystals, silver-white colour, and silky lustre.

4. Native Alum. Sulphate of Alumina.

Generally greyish; sometimes translucent; commonly only glimmering; occasionally with silky lustre; sometimes earthy. Specific gravity 2071. Contents, Sulphuric Acid 24; Alumina

* On their origin, consult DE LUC's *Geological Letters*, in VOIGT's Magazine. Vol. XI. P. 4. p. 37.

† FR. STROMEYER, *de Polyhalite, nova e salium Classe Fossilium Specie in Comm. Soc. Götting. recentior*. Vol. IV. p. 139.

18 ; Water 58. Taste astringent, acerb, and subsequently sweet. Found principally in the Kingdom of Naples; occasionally upon Alum-stone, &c. Used in dyeing, &c.

(C.) *In combination with Metallic Oxydes.*

5. Native Vitriol.

Sulphates of Metallic Oxydes, principally Copper, Iron, Zinc, and Cobalt; and commonly of several of these Oxydes combined together; in which case they are named *à potiori*.

(1.) *Cupreous Vitriol. Blue Vitriol. Sulphate of Copper. Fr. Couperose bleue.*

Blue, passing into verdigris-green; translucent; with vitreous lustre; commonly stalactical. Specific gravity 2230. In the fire it gives a blue flame; Iron rubbed with its solution becomes copper-coloured. Taste acerb, astringent, nauseous, cupreous. Found near Herrengrund, in Hungary, &c.

(2.) *Iron Vitriol. Green Vitriol. Sulphate of Iron. Fr. Couperose verte.*

Generally verdigris-green, but when disintegrated, ochre-yellow; sometimes, also, as a white covering to Iron Pyrites; commonly translucent; taste acerb, astringent, inky. Found on the Rammelsberg, near Goslar, but also upon Volcanoes, in Coal-pits, &c*.

The Mountain-Butter, Stone-Butter. *Russ. Kamenomaslo*, deserves notice as a distinct Variety. It is yellow, translucent, with waxy lustre, foliated, greasy to the touch, and found abundantly in Siberia, on the Altai, Ural Mountains, &c.

(3.) *Zinc Vitriol, White Vitriol. Sulphate of Zinc. Fr. Couperose blanche.*

Yellowish-white; glimmering; commonly with fibrous fracture; sometimes in the form of a mealy deposit; sometimes capillary, as in many kinds of the so called Feather-Alum; sometimes stalactitic, &c. Also found in the Rammelsberg.

(4.) *Cobalt Vitriol. Sulphate of Cobalt.*

Pale rose-red; with vitreous lustre; translucent; stalactical. Found near Herrengrund, in Hungary.

* The stone, known under the name of Ink-stone, is composed of extraneous fragments used to fill up holes in mines, which have been penetrated and agglutinated by Vitriolic water, and from which Vitriol is principally procured; at Goslar, for instance.

BECKMANN has shewn in his *Beyträge zur Geschichte der Erfindungen*. Th. 2. S. 92. that this Inkstone is probably the *Alumen* of the Ancients.

III. Salts of Nitric Acid.

1. Native Salt-petre. Nitrate of Potash.

Whitish; commonly transparent; sometimes glittering; at others glimmering; generally in delicate needles, or cottony; sometimes stalactical. Specific gravity 1920. Taste bitter, cooling. It melts in the fire and decrepitates on hot coals; it is for the most part mixed with Lime in Salt-petre Earth, as it is called. Found principally in Ludama, (in the interior of Africa,) in Hindostan, and also in certain parts of Europe, as Hungary, Apulia, near Homburg, in the county of Würzburg, and near Gottingen, on the Sandstone of Reinhouse*. Extensively employed in making Gun-powder, Nitric Acid, &c.

IV. Salts of Boracic Acid.

1. Tincal. Crude Borax. Borate of Soda. Swaga of the inhabitants of Thibet.

Generally greenish-grey; translucent; with waxy lustre; fracture foliated in a curved direction; crystallized in flat six-sided prisms, with obliquely bevelled extremities; Taste first sweetish, and afterwards caustic; readily melts in the fire. Found in some Alpine lakes of the snowy mountains of Thibet and Nepal. Used in soldering, &c.

2. Sassolin. Native Boracic Acid.

In yellowish-white leaves with almost silvery lustre, scaly, or resembling Mica. Contents, Boracic Acid 86; Sulphate of Manganese 11; Sulphate of Lime 3. (KLAPROTH.) Found near the hot springs of Sasso, in the Territory of Florence. The Native Boracic Acid found in the cleft of a rock upon the Volcano of Lipari, and from which also hot springs issue, on the contrary, is combined with from 5 to 20 per Cent. of Sulphur. (STROMEYER. *Göttin. gel. Anz.* 1818. S. 2073.)

V. Salts of Carbonic Acid.

1. Native Natron. Carbonate of Soda. Native Mineral Alkali.—Borech of the Persians.—Trona in Barbary.—Nitrum of the Ancients.

Whitish, yellowish, greyish, &c.; generally earthy, but sometimes massive; translucent; with dull lustre; sometimes aggregated in a columnar manner on the fracture; very soluble in water; taste alkaline. Contains various quantities of

* See C. F. BECKER'S *Anleitung zur künstlichen Erzeugung des Salpeters*. Braunschw. 1814. 8vo.

Carbonic Acid; sometimes 38 per Cent. Found particularly in the Natron Lakes of Egypt, &c. The ancient Egyptians macerated the bodies of the dead in this salt during a month previous to making them into mummies*; and it is said that merchants shipwrecked on the shores of the Belus discovered its power of forming glass. In the East it is still extensively employed for the latter purpose, as also for making soap, for bleaching, dyeing, and as a condiment.

The Aphonitum which is deposited on damp walls in the form of cottony mucor, and which is sometimes improperly called Saltpetre, consists of impure native Soda mixed with Lime.

SECT. XIV.

OF COMBUSTIBLE MINERALS.

§ 251. All those Fossils are in fact called combustible, which combine so rapidly with Oxygen as to disengage heat and light. Consequently, Metals strictly speaking, also belong to this Class. But as these differ remarkably from all other Mineral Bodies by many peculiar characters, they are in consonance, with the general division already mentioned, (§ 241.) placed in a separate Class, and only the four following Genera ranged among combustible bodies, properly so called:—

- | | |
|-----------------------------------|----------------|
| I. Native Sulphur. | III. Graphite. |
| II. Bitumen. <i>Ger.</i> Erdharz. | IV. Diamond. |

§ 252. The first of these Genera, and most of the Species of the second, agree among themselves and differ from the other two in this respect, that when pure, they are soluble in oil, that they burn with smoke, flame, and a peculiar odour, or at least glow, and that they are capable of supporting combustion. One Species of Bitumen, Petroleum, is fluid. The remaining solid ones are powerfully idio-electric.

* I examined this Salt in the mummies which I was permitted to open in the British Museum, Feb. 18, 1791. See *Phil. Trans.* 1794. p. 183. Tab. 16. fig. 4.—And *Beyträge zur Naturgeschichte.* Th. 2. S. 53.

I. SULPHUR.

1. Native Sulphur. Brimstone. *Ger.* Schwefel. *Fr.* Soufre. In a variety of shades of its well known colour ; more or less translucent ; lustre greasy ; fracture conchoidal ; brittle ; commonly amorphous, and as well of loose as compact structure ; sometimes stalactical ; sometimes crystallized in three-sided or double four-sided pyramids. Specific gravity 2033. Melts at 244° *Fahr.* and at 414° bursts into flame. Often impure, as Sulphur-earth, &c. Found principally in strata of Gypsum, as for instance, near Lauenstein, in the Kingdom of Hanover ; also in and near Volcanoes.

II. BITUMEN.

1. Mellite. *Ger.* Honigstein.

This as yet imperfectly understood Mineral is commonly honey-yellow ; translucent ; with vitreous lustre ; very brittle ; with small conchoidal fracture ; always crystallized, commonly in double four-sided pyramids ; and when rubbed, evinces resinous electricity. Specific gravity 1666. Contents, Alumina 16 ; a peculiar acid (the Mellitic) resembling the vegetable acids, 46 ; Water 39 ; (KLAPROTH.) Found, sometimes with native Sulphur, in Bituminous Wood and Wood Earth, near Artern, County of Mansfeld.

2. Amber. *Ger.* Bernstein. *Agtstein.* Succinum, lyncurium, glessum. *TACIT.*

Passing from white into dark orange-red ; and from transparent into perfectly opaque ; rarely limpid, but commonly as clear as oil ; lustre sometimes vitreous, sometimes waxy ; fracture conchoidal ; sometimes in particular shapes, as pear-shaped or globular drops. It may be turned, polished, &c. Specific gravity of a transparent wine-yellow specimen, 1083. Contains a peculiar Acid, the Succinic. It has probably originated from Resin in some of the early revolutions of the Earth ; it not uncommonly includes foreign bodies* particularly wood, insects, &c. Found chiefly at Samland, in East

* In a very instructive series of Specimens of Amber, presented to me by Count FINKENSTEIN SCHÖNBURG, are, among other objects, many very distinct Insects, partly unknown, and partly resembling tropical Species, particularly *Staphylini*, *Blattæ*, &c.

Prussia ; sometimes in layers of Bituminous Wood* and brown Coal ; sometimes on the sea-coast.

3. Petroleum. Fossil Tar. *Ger.* Erdöhl.

More or less fluid ; sometimes perfectly so, (Naphtha) ; sometimes, on the contrary, very tenacious, like thick Tar, (Maltha, Mineral Tar); equally various in colour and transparency ; Naphtha, for instance, in many shades of yellow ; Mineral Tar passing into black-brown ; (the true Barbadoes Tar greenish-brown) ; the former transparent, the latter, on the contrary, barely translucent in slender threads. Mean specific gravity 0.850. Its odour is very powerful. Naphtha is found particularly in the burning lands near the Caspian Sea ; the Mineral Tar chiefly at Barbadoes, but also near Edemissen, in the District of Meinersen, (Kingdom of Hanover,) and other places. The Naphtha is used for lights, fuel, &c. ; the Mineral Tar, as a medicine, &c. That from Barbadoes is also employed in the treatment of obstinate affections of the skin, and even of cancerous diseases.

4. Mineral Pitch. Bitumen. *Ger.* Erdpech.

(1.) *Common Bitumen. Asphalt.*

Generally black, and brown only in translucent splinters ; lustre sometimes greasy, sometimes vitreous ; fracture generally conchoidal ; very brittle ; gives a liver-brown streak ; has a peculiar bitterish smell ; burns with a dense vapour. Specific gravity 1104. Found principally on the Dead Sea, to which it has communicated its Greek name. It was employed by the ancient Egyptians in their compositions for embalming mummies. It is still used by the Turks, Arabs, &c., when dissolved in oil, to preserve the harness of their horses, to drive away flies, &c. Among the Varieties, the odoriferous and costly Mountain Balsam, *Pers. Muminahi*†, procured from the clefts in rocks in Khorassan, at the foot of Caucasus, deserves notice.

(2.) *Elastic Bitumen. Mineral Caoutchouc.*

This singular Fossil is brown, without lustre, and very elastic ; it does not, like vegetable Caoutchouc, admit of extension,

* Among this, though very rarely, almond-shaped seed-capsules of the primitive Amber Tree, also completely unknown, are sometimes found ; for specimens of which I am indebted to the kindness of M. HAGEN, of Königsberg.

† This Persian name was first applied in the thirteenth Century, to the bodies embalmed by the ancient Egyptians, which have ever since been universally termed mummies.

but like soft cork, when compressed, it immediately resumes its former condition. Found near Castleton, in Derbyshire, in the two following Varieties :—

(a.) *Compact.*

Black-brown, sometimes passing into olive-green; softens when heated; and in general resembles the vegetable Caoutchouc in its external characters more closely than the next Variety;

(b.) *Spongy.*

Hair-brown; structure spongy, sometimes passing into fibrous; tougher than the compact kind.

5. Bituminous Wood. *Oryctodendron.*

Hair-brown, sometimes passing into black-brown, as in the *Surtar-brandr*, or Black Wood of Iceland; with more or less evident ligneous texture. Passes into brown Coal and Jet; sometimes found in extensive strata*; sometimes contains Alum. The Bituminous Wood-earth, to which also many kinds of Umber belong, (that of Cologne for instance,) is produced by the disintegration of Bituminous Wood, and is found partly in strata near it, and partly also in alluvial land, peat moors, &c.†

6. Black Coal. Common Coal. *Ger.* Steinkohle. *Fr.* Houille. Charbon de Terre.

Beyond a doubt, of vegetable origin; sometimes with evident ligneous texture; or with impressions of extraneous plants; sometimes intermixed with Wood Coal; burns with black smoke; consists of Bitumen and Carbon in various proportions; according to its colour, lustre, structure, &c., it forms

* Some have supposed that these strata of Bituminous Wood, so important geologically, as monuments of the catastrophes of the primitive World, have been deposited by currents, &c., in the manner of the drift-wood cast at present on the shores of the Northern World. Just on the contrary, it appears to me that many kinds of drift-wood, that, for instance, which is cast on shore near Stad, in this kingdom, the fissures in which I found filled with blue Iron Earth, have been originally detached from strata of fossil Bituminous Wood, previous to being thrown on the shore.

† Peat itself.—*Ger.* Torf. *Fr.* Tourbe.—consists of Plants, chiefly Mosses and Grasses, in a state of decay or merely closely matted together, and more or less impregnated with Bitumen; in some places it also contains Heaths, &c. Peat is for the most part certainly of recent origin, whence many naturalists have been induced to exclude it from the rank of fossils. But as we find that certain Peats placed inland, consist of Marine Plants, Fuci, &c. and consequently belong to the remote periods of the primitive revolutions of the Earth, many kinds evidently passing into brown Coal, this appears to be its most suitable place in a System of Natural History.

the six following Varieties, which, in a geognostic point of view, may be arranged under two principal heads; the four first approaching more or less closely to Bituminous Wood, occurring in extensive strata, resting on common Flötz Sandstone or compact Limestone, and usually covered by Basalt; the two latter, on the contrary, occur in less extensive strata, commonly only a few feet thick, several of which however alternate with each other, and with layers of Slate Clay or Coal Sandstone. The latter kinds are also found more in the vicinity of mountains containing veins, and are almost always covered by Coal Sandstone, Slate Clay, (Shale) with impressions of Plants, and Slag. *Ger. Brandschiefer.* (Bituminous Shale.)

(1.) *Brown Coal. Bovey Coal.* *Ger. Braunkohle. Erdkohle.*
Dark-brown; with dull lustre; it passes into Alum Earth as well as into Bituminous Wood, from the latter of which it is distinguished by having a less evident ligneous texture.

(2.) *Pitch Coal.* *Ger. Pechkohle. Fettkohle.*
Coal-black, as are also the following Varieties; lustre considerable; fracture small conchoidal.

(3.) *Columnar Coal.* *Ger. Stangenkohle.*
In detached columnar pieces; generally with greasy lustre; soft; brittle. Found at Meissner, in Hesse.

(4.) *Jet. Black Amber.* *Ger. Gagatkohle. Schwarzer Bernstein.*
Fr. Jayet.
Coal-black; with dull lustre; flat conchoidal fracture; sufficiently hard to admit of being turned and polished. Similar to this is the Cannel, or Kennel Coal, of Lancashire, of specific gravity 1275.

(5.) *Slate Coal. Foliated Coal.* *Ger. Schieferkohle. Blätterkohle.*
Of slaty texture; lustre waxy; soft and very brittle. Passes into Bituminous Shale.

(6.) *Glance Coal.* *Ger. Glanzkohle.*
Iron-black; lustre almost metallic; fracture large conchoidal; fragments of a cubical form; it affords the best fuel, and is very common in Great Britain.

Besides the common uses of Coal, the two last kinds are employed for procuring Tar and Sal Ammoniac.

III. GRAPHITE.

1. Anthracite. (Slaty Glance Coal.) *Ger.* Kohlenblende.
Fr. Plombagine charbonneuse.

In external appearance it resembles Glance Coal, with which it was formerly often confounded; it soils the fingers considerably; very brittle; structure sometimes slaty, sometimes columnar in small four-sided prisms. Specific gravity 1468. Contents, according to GUYTON MORVEAU, Carbon with a little Oxygen, and about 4 per Cent. of Alumina. Generally found in or near Quartz; among other places, at Gera, Schemnitz, &c., and at Kongsberg, with native silver.

2. Graphite. Black Lead. Wad. Plumbago. *Ger.* Reissbley.
Fr. Plombagine.

Generally lead-grey; sometimes iron-grey; with more or less of metallic lustre; soils the fingers; greasy to the touch; sometimes compact; at others, granular, or scaly, or foliated, or thin slaty; soft. Mean specific gravity 2089. Composed, according to VAUQUELIN, of Carbon, with 8 per Cent. of Iron. In the open fire it burns, leaving behind a little Iron and Silex. It is found of the best quality, and in large quantity, at Keswick, in Cumberland*. The finer kind is used for pencils, and for the points of Paratonnerres; the inferior for making crucibles, stoves, &c., and as an application to wooden screws and wheels.

IV. DIAMOND.

1. Diamond. *Ger.* Demant. *Fr.* Diamant.

In every respect one of the most remarkable and wonderful, as well as valuable, objects in nature. Properly colourless, and limpid as a drop of dew; but sometimes with a pale tinge, and that of almost all colours; lustre peculiar, and approaching to metallic; originally always crystallized; and properly, as a double four-sided pyramid, (Tab. 2. fig. 5.) the surfaces of which are, however, commonly arched, and sometimes so pointed in the middle as to convert the octohedron into a dodecahedron with rhomboidal planes. (Tab. 2. fig. 13.)

* I am indebted to the late BARON VON ASCH for an exotic curiosity, consisting of some very fine graphite, from Tschukotskoinoss, the extreme point of Asia, to the North-East, which is employed by the Tschukotski, and the Polar Nations on the opposite Coasts of the North-West of America, as a cosmetic, and for colouring their clothes and furniture.

Its structure is foliated in a direction corresponding to the planes of the primary octohedron, in which direction only it admits of cleavage*. It is the hardest of all known bodies, resisting the action of the file, and scratching all other precious stones; for which reason it can only be polished by means of its own powder. Specific gravity 3521. It is powerfully idio-electric; and many absorb light with great facility. What NEWTON had suspected, (*Optice*. p. 270, 272. Ed. cit.) from having observed its powerful refraction, that the Diamond was a combustible substance, is now fully established; it having been shewn to consist of Carbon in a wonderfully condensed state; so that even Steel may be formed from Iron placed in contact with Diamond in a state of combustion. Diamonds are found in the East Indies (principally Hindostan and Borneo) and the Brazils. (See OSIANDER'S *Notice in the Götting. gelehrt. Anzeig.* 1805. S. 1777, &c.

SECT. XV.

OF METALS.

§ 253. It has been already mentioned, (§ 251.) that in strictness, Metals should be arranged among combustible Fossils. They are distinguished, however, by the following properties, as well from the substances treated of in the preceding Section, as from the minerals of the other two Classes.

They are the heaviest objects in nature, and the most perfectly opaque of all Fossils; they all have the lustre, from that circumstance called metallic; their fracture is generally uneven; and many of them possess ductility, which may be of three kinds: viz., they are, firstly, flexible, as Lead and

* The identity of the direction of the Lamellæ in both its crystalline forms, the octohedron and dodecahedron, is clearly demonstrated in a series of Diamonds in my Collection, which have been cleaved in the various directions, and presented to me by the celebrated Polisher of Diamonds, BEMELMANN, of Amsterdam.

Tin in particular ; secondly, they are extensible or malleable, so as to admit of being beat out into thin leaves, Gold and Silver particularly ; and thirdly, they are tenacious, so as to allow of being drawn into the form of Wire, more or less perfectly, according to their different degrees of tenacity ; wires of similar size, but of different Metals, supporting more or less weight previous to giving way ; the principal of this kind are Platina, Gold, and Iron.

They are rendered fluid by Caloric, *i.e.* they melt ; in the case of Quicksilver, this takes place at a very low temperature, whence it is usually observed liquid, whilst, on the contrary, the other Metals require an elevated temperature, and many of them, as Platina, Iron, Manganese, Tungsten, &c., an extreme heat previous to fusing. All, when melted, are opaque and convex on the surface.

With one or two exceptions among the recently discovered Metals, all are soluble in Nitric, or Muriatic, or Nitro-Muriatic Acids, and are most perfect conductors of Electricity.

§ 254. However varied the appearances with which Metals ordinarily present themselves in the natural state, all the differences may be reduced to two principal heads.

Either they are found *native* in their perfect metallic form, or they are *mineralized* in the most extended sense of the word, being deprived of more or less of their metallic habit.

§ 255. But even in the native state there are various distinctions. The Metal, for instance, is either visible or concealed in minute particles among other Fossils, and in that way disguised. Again, a native Metal, Quicksilver for instance, is either found pure by itself, or else several are mixed together in their native state, in the Natural Amalgam, for instance.

§ 256. The mineralization of Metals (§ 254.) also takes place in different ways :—

First, merely by a combination of a Metal with another combustible substance, as Sulphur ; in this instance the Metal is said to be sulphuretted. In such combinations they generally retain a metallic lustre.

§ 257. Secondly, by a much more essential change, *viz.* by the combination of Metals with Acids ; in which case they are deprived of their metallic lustre, and are said to be acidified or oxydated.

And again, this oxydation takes place either by the imme-

diate access of Oxygen, pure, or else combined with a Basis, and forming an Acid.

§ 258. But ten Metals, viz. Silver, Quicksilver, Copper, Iron, Bismuth, Antimony, Nickel, Arsenic, Tellurium, and Palladium, have as yet been found in both forms, native and mineralized. Of the remainder the greater number are mineralized only.

§ 259. It needs scarcely be mentioned that the ancient division of Metals into perfect and imperfect or Semi-metals, was founded on relative and indefinite circumstances.

§ 260. The Metals at present known are,

I. Platina.	V. Copper.
II. Gold.	VI. Iron.
III. Silver.	VII. Lead.
IV. Quicksilver.	VIII. Tin.

These eight were formerly called perfect Metals; the following are those which were termed Semi-metals:—

IX. Zinc.	XIX. Titanium.
X. Bismuth.	XX. Tellurium.
XI. Antimony.	XXI. Chromium.
XII. Cobalt.	XXII. Tantalum.
XIII. Nickel.	XXIII. Cerium.
XIV. Manganese.	XXIV. Iridium.
XV. Arsenic.	XXV. Palladium.
XVI. Molybdenum.	XXVI. Cadmium.
XVII. Tungsten.	XXVII. Osmium.
XVIII. Uranium.	XXVIII. Rhodium.

The two latter having hitherto been found only in crude Platina combined with Iridium and Palladium, they are here only incidentally alluded to.

I. PLATINA.

Pure Platina, in the metallic state, is silver-white; of specific gravity 20,850, consequently the heaviest of all known bodies (when drawn into wire or much hammered, its specific gravity reaches 23,286); it is extremely extensible and tenacious*; it is soluble in Aqua Regia, and amalgamates with

* Dr. WOLLASTON presented me with Platina wire of the extraordinary fineness of $\frac{1}{32000}$ th, $\frac{1}{64000}$ th, and even $\frac{1}{128000}$ th part of an inch. I received also from the late Dr. INGEN-HOUSE a sheet of Copper covered on one side with Silver, and on the other with Platina, the thickness of the three layers of the different Metals collectively, not exceeding that of a sheet of paper.

boiling Mercury ; it is of more difficult fusion than any other Metal ; next to Iron it is the hardest, and like it admits of being welded. It is employed chiefly in making scales, Micrometer-wires, small crucibles, and pendulum knobs, pyrometers, Davy's safety lamp, Clarke's night-light without flame, the wheels of watches, and, combined with Copper and Arsenic, Telescope-mirrors.

1. Native.

Known since 1736 by the name of Platina, the Spanish diminutive from *Plata*, Silver. It commonly occurs in small, and almost steel-grey grains, sometimes roundish, sometimes angular, but usually flattened ; besides Platina they contain eight other Metals, viz. Copper, Iron, Titanium, Chromium, Iridium, Osmium, Rhodium, and Palladium ; and are principally found near Santa Fé, in Mexico, in a sand composed of magnetic Iron Sand, Granular Gold, globules of Quicksilver, and small Hyacinths.

II. GOLD.

Gold is exceedingly ductile in all three respects, viz. flexibility, malleability, and tenacity ; it is soft, but by continual hammering may be made hard enough for watch-springs. Specific gravity 19,257. It is soluble in Aqua Regia, and is precipitated from the solution by Sal Ammoniac, in the form of fulminating Gold, and by Tin in the form of the purple Precipitate of Cassius. It readily amalgamates with Quicksilver. Next to Iron and Manganese, it is probably the most generally diffused Metal.

1. Native.

Darker or lighter according to the proportions of other Metals, such as Copper, Silver, Iron, and Tellurium, mixed with it ; in a variety of particular forms, as foliated, reticulated, &c. Sometimes crystallized in cubes, octohedrons, &c. ; sometimes dendritic, &c. Occasionally found in Stream-works, as in Wicklow. (Ireland.) Very common as Gold-dust, in the sand of many rivers.

Frequently, however, it is merely disguised or concealed, as for instance, in the brown Iron Ore of Beresofsk, in the *Braun-erz* from the Rammelsberg, containing Galena and Blende, in Iron Pyrites, &c. ; also in the auriferous Coal (Brandstein) from Verespatak, in Transylvania.

III. SILVER.

Silver becomes yellowish-black when exposed to the vapour of Sulphur. Specific gravity 10,474. Very malleable and tenacious; the most sonorous Metal, Copper excepted; soluble in Nitric Acid, and precipitated by Muriatic Acid as Horn Silver, and by Mercury in the form of the *Arbor Dianæ*.

1. Native.

In many peculiar shapes, foliated, dentiform, capillary, reticulated, &c.; sometimes crystallized, and commonly in double four-sided pyramids; sometimes dendritic; sometimes in metallic petrifications, as in the *Frankenberg ears of corn*. It is never found altogether pure, but mixed with other Metals, as for instance, with Gold near Kongsberg, and on the *Schlangen-berg*.

2. Arsenical Silver.

Colour intermediate between Tin and Silver; fracture foliated; sometimes crystallized in six-sided prisms and pyramids; soft. Composition various; a specimen from *Andreasberg* contained, according to *KLAPROTH*, Silver 12.75; Arsenic 35; Iron 44.25; Antimony 4.

3. Antimonial Silver.

Tin-white; sometimes massive; sometimes crystallized in four and six-sided prisms and pyramids, or in six-sided tables. Contents, Silver 76; Antimony 24. (*KLAPROTH*.) Found near *Andreasberg*, and *Alt Wolfach*, in the principality of *Fürstenberg*.

4. Sulphuret of Silver. Vitreous Silver. *Ger.* Glaserz. *Silberkies*.

Blackish lead-grey; dull glimmering; gives a glittering streak; sometimes crystallized, and then usually in double four-sided pyramids; also in cubes, &c.; soft; very flexible; admits of cleavage; and sometimes so malleable that it may be stamped. Specific gravity 7215. Contents, Silver 75; Sulphur 25. (*BERGMANN*.) Found in the *Erzgebirge*.

5. Brittle Sulphuret of Silver. *Ger.* *Sprodes Glaserz*.

Generally Iron-black; sometimes fuliginous. Sometimes crystallized, and that commonly in very small six-sided prisms or tables; sometimes cellular; brittle. Specific gravity 7208. Contents, Silver 66.5; Sulphur 12; Antimony 10; Iron 5. (*KLAPROTH*.) Found principally in Hungary.

6. Earthy Sulphuret of Silver. Ger. Silberschwärze. Erdiges Glaserz.

Bluish black; soils the fingers; fine earthy; very soft; appears to be produced by the decomposition of the Black Silver and Sulphuret of Silver, in the vicinity of which it is usually found.

7. Muriate of Silver. Horn Silver. Ger. Hornerz.

Pearl-grey, passing sometimes into brown, sometimes into pistachio-green; translucent at the edges; lustre almost waxy; sometimes lumpy; or crystallized in cubes; or dendritic, as in the Siberian, from the Schlangenberg; soft; flexible; may be scraped. Specific gravity 4840. Contents, Silver 67.75; concentrated Muriatic Acid 21; Oxyde of Iron 6; Alumina 175. (KLAPROTH.) Found at Johannegeorgenstadt, in the Erzgebirge; in Cornwall, &c.

8. Red Silver. Ger. Rothgülden. Silberblende.

From light blood-red to dark cochineal-red, the latter passing into lead-grey and iron-black; more or less translucent; sometimes black-red by reflected light, and by transmitted light, blood-red (Ruby Silver); lustre almost metallic; sometimes crystallized, mostly in six-sided prisms with obtuse six or three-sided points; sometimes dendritic; gives a red streak. Mean specific gravity 5563. Contents of a dark specimen from Andreasberg, Silver 60; Antimony 19; Sulphur 17; Oxygen 4. (KLAPROTH.) Others also contain Arsenic. Found particularly at Andreasberg.

9. Black Silver. Ger. Schwarzgülden.

Iron-black, sometimes passing into steel-grey; lustre metallic; fracture small conchoidal; hard; brittle; sometimes massive, particularly near Schemnitz and Kapnick; sometimes crystallized in three-sided pyramids, as near Clausthal. Passes into grey Copper Ore.

IV. QUICKSILVER.

Quicksilver (Hydrargyrum) retains its Silver lustre unchanged in the air; is fluid without soaking or moistening; and at 39° below Zero (*Fahr.*) becomes solid and malleable. Specific gravity when fluid 13,568; when solid 14,391. (GEHLEN'S *Journal* B. 1. s. 434.) Is perfectly soluble in Nitric Acid; phosphoresces in vacuo; amalgamates readily with Gold, Silver, Tin, and Lead; hence its use in reducing Ores, gilding, making

mirrors, &c. Also employed in meteorological instruments, destroying insects, and is a powerful medicine.

1. Native. Virgin Quicksilver.

Generally in globular drops in the clefts and interstices of Quicksilver Ores. Found in Europe, chiefly in Idria and the Principality of Deux-ponts.

2. Native Amalgam.

Native Quicksilver amalgamated with Native Silver. Commonly only as an incrustation; but sometimes massive, knobby, &c.; soft. Contents, Quicksilver 64; Silver 36. (KLAPROTH.) Found in Deux-ponts.

3. Cinnabar.

From light scarlet to dark cochineal-red; sometimes opaque; at others more or less translucent; sometimes earthy; sometimes massive, and with almost metallic lustre; occasionally fibrous; or crystallized, and then commonly in four-sided pyramids; streak scarlet-red. Specific gravity variable. Contents, Quicksilver 80; Sulphur 20. (KIRWAN.) Found in Idria, Deux-ponts, Almaden, (Spain) China, and Mexico.

Bituminous Cinnabar. Ger. *Quecksilber Branderz* from Idria, is Cinnabar intimately mixed with Bituminous Slate.

The rare Fetid Cinnabar also found there, is scarlet-red, translucent; of sparry texture; and when rubbed gives out a smell of Sulphur.

4. Hepatic Cinnabar. Ger. *Quecksilber Leber Erz*.

From dark cochineal-red to iron-black; opaque; lustre dull glimmering; streak cochineal-red; soft; according to its texture, of two kinds:—

(a.) *Compact*, and (b.) *Lamellar* with concentric exfoliating layers, like many hæmatites*. Specific gravity 7937. Contains 70 per Cent. of Quicksilver. Found in Idria, where it is the most common Ore of Quicksilver.

5. Horn Quicksilver. Muriate of Mercury. Ger. *Quecksilber Horn Erz*.

Smoke-grey, yellowish-grey, &c.; translucent; lustre almost metallic; commonly in the form of drusy incrustations in the interstices of other Quicksilver Ores; sometimes in very small crystals, cubic or prismatic; soft. According to KIRWAN, it

* Among the most remarkable errors arising from a neglect of the study of petrifications, is the supposition of many modern and otherwise meritorious mineralogists, that these concentric exfoliations of the Hepatic Cinnabar were actual petrifications.

contains 70 per Cent of Quicksilver, combined with Muriatic and Sulphuric Acids. Found in Deux-ponts.

V. COPPER.

Copper is very hard and elastic, and the most sonorous of all Metals. Specific gravity 7788. Soluble in all acids; burns with a green and blue flame; combines readily with other Metals, forming various compositions; as for instance, with Gold, *Similor* and the Malay *Suasso*; with Zinc, *Brass*, and *Tombac* (from the Malay name of Copper, *Tombago*); with Tin, the ancient *Bronze*, *Bell-metal* and *Pewter*; with Arsenic, the *Argent haché* and the composition for the mirrors of telescopes; with Nickel, the Chinese *Packsong*; &c. In coinage it serves also for the alloy of Gold and Silver.

1. Native.

Sometimes auriferous or argentiferous; in various shades of red; in many peculiar forms; sometimes crystallized and commonly in double four-sided pyramids. Found in Europe, particularly in Cornwall and Hungary; in Asia, Siberia, the Copper Island (*Mednoi-Ostrow*) of the Sea of Kamtschatka; and in America, on the Copper-mine River, to the N. W. of Hudson's Bay, Brazil, &c.

Cement Copper, or native Copper of the second formation, is that which is precipitated by Iron from Waters containing Sulphate of Copper, as at Neusohl, in Hungary, Goslar, on the Rammelsberg, &c.

2. Sulphuret of Copper. Vitreous Copper. Ger. Kupferglas. Kupferglanz.

Lead-grey passing into iron-black, violet, dark liver-brown, &c.; lustre sometimes metallic; fracture foliated; commonly amorphous, but sometimes crystallized, as in six-sided prisms (Tab. 2. fig. 10.); soft; sectile; streak glittering; easily fused. Mean specific gravity 5074. Contains, according to KLAPROTH, from 50 to 80 per Cent. of Copper, combined, as in the following Species, with Iron and Sulphur. Found particularly in Cornwall and the Bannat.

3. Purple Copper. Ger. Bunt-Kupfer-Erz.

Tombac-brown, passing into Copper-red; generally with a tinge like a dove's neck; lustre metallic; more brittle than Vitreous Copper; streak brown-red; amorphous. Contains, according to KIRWAN and KLAPROTH, 40 to 70 per Cent. of Copper, with more Iron than the last Species; like it also,

passes into Copper Pyrites. Found at Lauterberg, in the Hartz, and on the Schlangenberg, in Siberia.

4. Copper Pyrites. Yellow Copper Ore. *Ger.* Kupferkies. Gelf.

Gold-yellow in a variety of shades ; sometimes greenish ; often iridescent ; usually amorphous ; fusiform, kidney-shaped, botryoidal, &c. ; sometimes crystallized, as in three-sided pyramids (Tab. 2. fig. 1.) Mean specific gravity 3980. Contains, according to KIRWAN, 20 per Cent. of Copper, with still more Iron than in the preceding Species. It is the most common Copper Ore ; is found, as are sometimes also the two preceding Species, in bituminous Marl-Slate, which is then called Copper-Slate.

5. White Copper. Arsenical Copper Pyrites. *Ger.* Weiss Kupfererz.

From tin-white to bronze-yellow ; with dull lustre ; brittle ; sometimes gives sparks with steel. Contains, according to HENKEL, 40 per Cent. of Copper, with Arsenic and Iron. Passes into Copper Pyrites and Grey Copper Ore. Very rare ; found near Freyberg.

6. Grey Copper Ore. *Ger.* Fahlerz. Graugültigerz. Weissgülden.

Steel-grey passing into iron-black ; streak greyish-red ; commonly amorphous ; sometimes crystallized in three-sided pyramids, six-sided prisms, &c. Besides Copper, it contains Antimony and Silver in variable quantities, and sometimes Lead, Iron, &c. Found in abundance in many countries of Europe and Asia.

7. Black Copper. *Ger.* Kupferschwärze.

Brownish-black ; earthy ; friable ; meagre ; commonly found covering Copper Pyrites and Grey Copper Ore, from the disintegration of which it probably originates. Found near Lauterberg, on the Hartz, &c.

8. Red Oxyde of Copper. *Ger.* Roth Kupfererz.

Passing from liver-brown, through light cochineal-red, into lead-grey ; the cochineal-red kind sometimes translucent ; rarely transparent ; lustre sometimes almost metallic ; compact, foliated, or crystallized ; and then commonly in double four-sided pyramids. Sometimes capillary, fibrous, with silky lustre (Flowers of Copper). Composed of Carbonate of Copper. Found in Cornwall and Catharinburg ; the Flowers of Copper, near Rheinbreidbach (Cologne).

9. Red Copper Ochre. *Ger. Ziegelerz.*

From hyacinth-red into pitch-brown and yellow; lustre dull or like pitch; sometimes earthy; sometimes indurated; the latter with small conchoidal fracture. In fact, belongs to the preceding Species, with the addition of Iron-Ochre. Found, among other places, in the Bannat, Lauterberg, on the Hartz, &c.

10. Blue Carbonate of Copper. *Ger. Kupferlasur. Kupferblau.*

Passing from sky-blue to indigo-blue; sometimes dull, earthy, coherent, leaving a stain; at others glittering, translucent, radiated, kidney-shaped or botryoidal; sometimes crystallized, chiefly in short four-sided prisms. According to KIRWAN, it contains 69 per Cent. of Copper, combined, as in the three following Species, with Carbonic Acid. Found in the Bannat, and on the Ural Mountains.

11. Malachite. Green Carbonate of Copper.

In two principal forms:—

First: *Fibrous Malachite*; emerald-green; with silky lustre; fibrous; sometimes in separate capillary crystals, diverging in the form of a tuft. Found at Lauterberg, on the Hartz, and in the Bannat.

Secondly, as *Compact Malachite*; capable of being polished; generally kidney-shaped or mamellated with concentric layers; sometimes botryoidal, stalactitic, cylindrical, &c. Specific gravity 3641. Contents of a Siberian specimen, Copper 58; Carbonic Acid 18; Oxygen 12.5; Water 11.5. (KLAPROTH.) Found particularly at Catharinburg, in Siberia.

12. Copper-Green. Chrysocolla. *Ger. Kupfergrün.*

Verdigris-green sometimes passing into blue; rarely translucent at the edges; sometimes earthy, friable; at others compact, with a conchoidal fracture; commonly found in small quantities in other Copper Ores, and usually contains Alumina beside Carbonate of Copper. Found at Saalfeld, Dillenburg and Catharinburg.

13. Ferriferous Copper-green. *Ger. Eisenschüssiges Kupfergrün.*

Commonly olive-green passing into pistachio-green; sometimes earthy, friable; at others firm, with greasy lustre; conchoidal fracture, knobby surface, &c. Composed of the last Species intermixed with brown Iron Ochre. Found in small quantities near Saalfeld, and in the Island of Elba.

14. Phosphate of Copper. *Ger. Phosphorsaures Kupfererz.*

From verdigris-green passing into emerald-green ; opaque ; glimmering ; with silky lustre ; fracture fibrous ; soft ; commonly botryoidal, kidney-shaped ; rarely in very small six-sided crystals. Contents, Oxyde of Copper 68.13 ; Phosphoric Acid 30.95. (KLAPROTH.) Found at Virneberg, near Rheinbreidbach.

15. Arseniate of Copper. *Ger.* Olivenerz.

Generally olive-green, passing on the one hand into dark leek-green, and on the other, into verdigris-green ; translucent or transparent ; with greasy lustre ; commonly crystallized ; and sometimes in six-sided tables (Copper Mica) ; sometimes in very flat octohedrons (Lenticular Copper Ore) ; and sometimes in small six-sided prisms, &c. ; the latter sometimes divergent, sometimes in small kidney-shaped masses, of which the fracture is fibrous, and has a silky lustre. (Wood Copper.) They all contain Copper combined with Arsenic Acid, and some Iron. Found at Carharack, in Cornwall.

16. Muriate of Copper. *Ger.* Salzkupfererz.

Of a variety of shades of green ; passing from opaque to transparent ; sometimes dull earthy ; sometimes with various degrees of lustre. In the *Atacamite* it is a green sand, with very small irregular grain ; translucent ; with vitreous lustre ; and burning with a fine blue and green flame. Contents, Oxyde of Copper 70.5 ; Muriatic Acid 11 ; Water 18. (PROUST.) Found in the West of South America, near a small river in the desert Atacama, between Peru and Chili.

VI. IRON.

Pure Iron varies in colour from steel-grey to silver-white, and is extremely tenacious. Specific gravity 7807. It is attracted by the Magnet, and itself readily becomes magnetic. It may be welded. It is acted on by all Acids, and communicates an inky taste to them. These solutions give a black precipitate with Gallic Acid, and a blue one with Prussic Acid. It is the most common of all Metals, and is even diffused through the organic creation. It is also formed by civilized nations into a greater variety of objects than any other Metal, whether as Cast or Bar-Iron, or after it has been made into Steel*.

1. Native.

* See Dr. PEARSON'S *Remarks on the properties and composition of the different states of Iron.* *Phil. Trans.* 1795. p. 337. with reference to his examination of the Indian Wootz.

Among the largest and the most celebrated of the masses of Native Iron is that which was re-discovered by PALLAS, in 1772, between Krasnojarsk and Abekansk, on a Slate-rock. It has a remarkable structure, partly branched, partly cellular, and contains in its vesicular interstices a greenish-yellow vitreous Fossil, resembling Olivine. The mass weighs 1600lbs. and according to HOWARD, consists of Iron with 17 per Cent. of Nickel. Another, and much larger mass, is near the River Parana, in Chaco, South America, where it was examined in 1782 by DON M. RUBIN DE CELIS, who estimated its weight at 30,000lbs. It contains 10 per Cent. of Nickel. A specimen of this mass, with which I was favoured by the kindness of Sir J. BANKS, is distinguished from the Siberian by its lighter colour, approaching to tin-white.

A specimen of Native Iron (not Meteoric) from Groscamsdorf, in Saxony, contained, according to KLAPROTH, Iron 92.5; Lead 6; Copper 1.5.

2. Iron Pyrites. *Ger.* Schwefelkies. *Eisenkies.*

Bronze-yellow in a variety of shades, passing on the one hand into gold-yellow, on the other into steel-grey; often iridescent or tombac-brown on the surface; with metallic lustre; commonly so hard as to give sparks with steel, emitting a sulphureous odour. Besides Sulphur and Iron, it sometimes contains Gold, Silver, Arsenic, &c. Three kinds are distinguished:—

(1.) *Common Iron Pyrites.*

In many peculiar forms, as kidney-shaped, globular, botryoidal, &c.; very frequently crystallized in various ways, as in double four-sided pyramids (Tab 2. fig. 5.); or in dodecahedrons with pentagonal planes (Tab. 2. fig. 4.); or in icosahedrons, with regular triangular planes with twelve corners (Tab. 2. fig. 6.), one of the most uncommon crystalline forms of Fossils; very commonly in cubes with striated planes, and that in such a manner that the striæ of any two corresponding planes have the same direction, and run in different courses in all three of the planes meeting at any of the corners of the cube. Mean specific gravity 4700. It passes into compact brown Iron Ore. It forms one of the most common Ores in all parts of the world.

(2.) *Radiated Iron Pyrites.*

The colour usually brighter than in the former; mostly in kidney-shaped masses; generally crystallized in double four-

sided pyramids, grouped together in the Cockscomb Pyrites*: fracture radiated; in many instances in the form of distinct acicular crystals (Capillary Pyrites), as for instance, near St. Andreasberg, on the Hartz.

(3.) *Hepatic Pyrites.* Ger. *Leberkies.* *Wasserkies.*

Also clearer than Common Pyrites; often tombac-brown on the surface; in peculiar forms, as kidney-shaped, stalactitic, tubular, reticular, cellular, &c.; sometimes crystallized in small six-sided prisms, &c. Sometimes, also, in the form of metallized petrifications of the primitive world, principally Ammonites. Pyrites, particularly the common kind, is employed to obtain Sulphur, Alum and Sulphate of Iron; and formerly, instead of Flint in the muskets of the Germans.

3. Magnetic Iron Pyrites. Ger. *Magnetkies.*

From tombac-brown to bronze-yellow; with metallic lustre, but generally tarnished; usually amorphous; very rarely crystallized in six-sided tables and prisms, which are sometimes bevelled at the extremities†. Like many other Ores of Iron it is magnetic. It passes into common Iron Pyrites. It is found in veins; at Breitenbrunn, in the Erzgebirge, for instance.

4. Magnetic Iron Ore. Oxydulated Iron. Load-stone. Ger. *Magnet-Eisenstein.* Fr. *Aimant.*

Iron-black; generally amorphous; sometimes, however, crystallized in small double four-sided pyramids; hard; brittle; distinguished by two remarkable qualities, viz., its polarity, and its power of attracting Iron; both of which it imparts to Iron. Specific gravity 4243. The quantity of Iron contained in it varies, but sometimes amounts to 80 per Cent. Found chiefly on the Magnetic Mountain, in Werchoturja, and also, among other places, at Spitzenberg, on the Hartz, as mentioned by AGRICOLA. *De Natura Fossilium.* L. 5. p. 604.

5. Titaniferous Oxydulated Iron. Ger. *Titaneisen.*

Sometimes brownish, sometimes Iron-black; the former with little lustre; the latter with iron-lustre; the fracture sometimes conchoidal, sometimes foliated, sometimes granular with many angles; hard; brittle. Specific gravity 4667. Con-

* J. F. L. HAUSMANN, in *Comment. recent. Soc. Reg. Scient. Götting.* Vol. III.

† HAUSMANN, *de relatione inter corpor. Natur. inorganic. indol. chemicas atque externas.* p. 34.

STROMEYER'S *Analysis.* Götting, *gel. Anzeig.* 1814. S. 147.

tents, Oxyde of Iron 78 ; Oxyde of Titanium 22. (KLAPROTH.) Found at Spessart, and near Eggersund, Krageroe, &c., in Norway.

6. Chromate of Iron. *Ger. Chromeisen.*

From steel-grey into blackish-brown ; dull glimmering ; streak ash-grey ; fracture coarse uneven ; hard ; brittle ; commonly amorphous. Infusible by itself, but melts with Borax, which it colours green. Specific gravity 4032. Contents, Oxyde of Iron 34.7 ; Chromic Acid 43 ; Alumina 20 ; Silex 2. (VAUQUELIN.) Found particularly in the Department du Var, and near Baltimore (N. A.), in octohedral crystals.

7. Specular Iron. *Oligist. Iron Glance. Ger. Eisenglanz. Spiegeleisen.*

Steel-grey ; sometimes with an iridescent tarnish ; with a vivid metallic lustre ; as well amorphous as crystallized ; the latter in double three-sided pyramids, sometimes lentiform ; or in six-sided tables, &c. Specific gravity 5158. According to KIRWAN, it contains from 60 to 80 per Cent. of Iron. It is usually magnetic. Found in great variety and beauty of crystalline forms, in the Island of Elba.

Iron-Mica is black ; of foliated texture ; as well amorphous as crystallized in small six-sided tables, which are sometimes aggregated in a cellular form. Found sometimes in the Woodstone, from Kieffhäuserberg, and in many Vesuvian Lavas.

8. Red Iron Ore. *Ger. Roth-Eisenstein.*

Generally brownish-red, passing on the one hand into cherry-red, on the other almost into steel-grey. There are three kinds ;—

(1.) *Scaly Red Iron Ore. Ger. Roth Eisenrahm.*

Powdery ; friable ; greasy to the touch ; soiling the fingers ; sometimes massive ; sometimes as an incrustation on other Ores of this Species ; very light.

(2.) *Compact Red Iron Ore. Ger. Dichter Roth-Eisenstein.*

Generally amorphous ; sometimes crystallized in cubes, as at the Cape ; soils the fingers and gives a blood-red streak. When earthy and friable it is called *Red Ochre*. (*Ger. Roth-Eisenoche.*)

(3.) *Fibrous Red Iron Ore. Hematite. Ger. Rother Glaskopf.*

Generally kidney-shaped, with mamillary surfaces and conchoidal scales ; sometimes stalactitic or in wedge-shaped fragments, with radiated texture. Contains 80 per Cent. of Iron. Used in the state of powder for polishing Steel.

9. Brown Iron Ore. *Ger. Braun-Eisenstein.*

Generally clove or hair-brown, passing on the one hand into yellow, on the other into black-brown. It usually contains Oxyde of Manganese.

(1.) *Compact Brown Iron Ore. Ger. Dichter Braun-Eisenstein.* Usually amorphous; sometimes stalactic, &c.; sometimes crystallized in dodecahedrons with pentagonal planes (Tab. 2. fig. 4.), and in cubes with the planes striated, as in Iron Pyrites (Tab. 2. fig. 2.) Sometimes also in petrifications of incognita of the primitive world, as in the *Screw-stone*, near Rübeland, in the Hartz; the Fungite, &c. When amorphous, it passes into Spathose Iron and Iron-Clay-stone.

As in the preceding Species, there is also *Brown Iron Ochre*, of which kind is the true or Turkish *Umber*.

(2.) *Fibrous Brown Iron Ore. Ger. Brauner Glaskopf.*

Except in colour, closely resembling the Red Hæmatite. The fracture sometimes fibrous, with silky lustre.

10. Spathose Iron. Carbonate of Iron. *Ger. Spath-Eisenstein. Eisenspath.*

From yellowish-grey to brownish-black; sometimes translucent at the edges; frequently crystallized, and chiefly in rhombs or lenses; brittle; the fragments usually rhomboidal. Specific gravity 3784. Contents of a specimen from Danke-röde, Oxyde of Iron 57.5; Oxyde of Manganese 3.5; Lime 1.5; Carbonic Acid 36. (KLAPROTH.) Passes into Brown Iron Ore.

11. Clay Iron-stone. *Ger. Thon-Eisenstein.*

Passing from yellowish into red-brown and black-brown; sometimes, also, smoke-grey; generally earthy; soft; meagre; sometimes amorphous; but also in a variety of peculiar forms; sometimes with petrifications belonging to the primitive world; for instance, with shells and impressions of plants (as in the Cat's Heads from Colebrook-Dale, each of which incloses a small Fern). It generally contains a considerable quantity of Iron, sometimes 40 per Cent.

Among the most remarkable Varieties are—

(a.) *Columnar Clay Iron-stone. Ger. Nagelerz.*

Red-brown; in distinct columnar portions; sometimes resembling Prismatic Basalt in miniature. Probably of pseudo-volcanic origin. Found particularly near Hoschenitz, in Bohemia.

(b.) *Geodic Clay Iron-stone. Ger. Eisen-niere.*

Generally yellowish-brown; reniform; sometimes with con-

choidal exfoliations ; usually hollow, and often including loose rattling fragments ; sometimes compact, globular*.

(c.) *Pisiform Clay Iron-stone.* Ger. *Bohnerz*.

Commonly dark-brown ; with greasy lustre ; in large grains with rounded angles ; sometimes compressed, rounded ; such for instance, is the Variety in large round beans, from the Cape.

(d.) *Lenticular Clay Iron-stone.* Ger. *Linsenerz*.

In small aggregated grains, sometimes almost like a loose Roe-stone.

12. *Bog Iron Ore.* Ger. *Rasen-Eisenstein*.

Yellowish-brown, sometimes passing into blackish ; dull, or with greasy lustre ; usually aggregated in loose fragments ; earthy ; sometimes in a variety of peculiar forms, tabular, &c. ; sometimes inclosing vegetables of recent origin, mosses, root-fibres, &c. Contains as much as 35 per Cent. of Iron, probably combined with Phosphoric Acid. Found under the vegetable mould, in alluvial lands and mosses.

13. *Phosphate of Iron.* Ger. *Eisenblau*.

(1.) *Foliated.*

Usually indigo-blue ; translucent ; foliated ; the fracture with vitreous lustre ; soft ; sometimes crystallized in small four-sided prisms. The latter is found near Bodenmais, in Bavaria †.

(2.) *Earthy.*

At first whitish ; but when exposed to the air, blue in various shades ; earthy, powdery, or aggregated ; soiling ; meagre. Contents of that from Eckardsberg, Oxyde of Iron 47.5 ; Phosphoric Acid 32 ; Water 20. (KLAPROTH.) Found on the banks of the Stecknitz, in Hanover, and also in the Fossil drift-wood, near Stade.

19. *Green Iron Ore.* Ger. *Grün Eisenerde*.

Generally canary-green ; earthy, friable, soiling ; rarely indurated. Its composition not yet completely known. Found near Schneeberg, in the Erzgebirge.

15. *Arseniate of Iron.* Ger. *Würfelerz*.

Olive-green ; transparent ; with greasy lustre ; soft ; in small

* Such are the masses found at Aberlady, in Lothian, as large as a man's head, and traversed by septa of Pearl Spar, which have become celebrated by HUTTON's Theory of the Earth. See FAUJAS SAINT-FOND, *Voyage en Angleterre*. T. 1. p. 124.

† See HAUSMANN, in *Denkschr. der K. Akad. der Wissensch. zu München*. B. 7. Abth. 2. S. 233.

cubic crystals with many variations. Generally from brown Iron Ore, at Carharrack, in Cornwall.

16. Pitchy Iron Ore. *Ger.* Eisenpecherz.

Commonly dark liver-brown, and fire-red at the angles ; translucent ; lustre pitchy ; fracture conchoidal ; streak citron-yellow. Specific gravity 2407. Contents, Oxyde of Iron 33.46 ; Oxyde of Manganese 0.59 ; Arsenic Acid 26.6 ; Sulphuric Acid 10.75 ; Water 28.48. (STROMEYER.) Found near Freyberg, and in Upper Silesia.

VII. LEAD.

Lead when exposed to the air becomes black ; and when rubbed gives a stain and emits a peculiar smell. It is the softest of the perfect Metals ; is flexible, but not very extensible, and but slightly tenacious. Specific gravity 11.352. It melts below a red heat ; burns readily into an Oxyde ; vitrifies gradually at an elevated temperature ; and is soluble in all acids, communicating a sweetish taste to them. It is used in making ball and shot, types, covering roofs, for pipes, in mining and assaying, and for many dyes.

1. Galena. Sulphuret of Lead. *Ger.* Bleyglanz.

Lead-grey, sometimes with an iridescent tarnish ; generally amorphous, with vivid metallic lustre ; sometimes cellular, dendritic, reticulated*, &c. ; very commonly crystallized, and usually in cubes ; rarely in double four-sided pyramids, or six-sided prisms ; all these forms occurring in many Varieties. It is found in cubical fragments ; has usually a foliated structure, with a more or less coarse grain. Mean specific gravity 7290. Contents variable ; for instance, Lead 77 ; Sulphur 20 ; with always more or less Silver, and also Antimony in the Striated Lead Ore. It is one of the most common Ores.

The Compact Galena. *Ger.* Bleyschweif, is more steel-grey, glimmering, softer, more soiling, and always amorphous. It is found, among other places, near Clausthal, and in Derbyshire†.

* A specimen of reticulated Galena, from the Island of Ila, presented to me by Dr. CRICHTON, exceeds in elegance every thing of the fossil kind that I have seen in that form.

† The celebrated *Slickensides*, of the Derbyshire mines, consists of the mirror-like surfaces of the Compact Fluor found there, covered with a thin lead-coloured layer, consisting of Galena with phosphoretted Hydrogen. In breaking it, the access of atmospheric air often gives rise to violent and

2. Black Lead Ore. *Ger.* Schwarz Bleyerz.

Greyish-black ; sometimes translucent ; streak greyish-white ; lustre peculiar, almost metallic ; usually crystallized in small six-sided prisms. Found, among other places, near Freyberg, containing 60 per Cent. of Lead.

3. Carbonate of Lead. *Ger.* Weiss Bleyerz.

From snow-white to yellowish-grey ; more or less translucent ; usually with adamantine lustre ; as well amorphous as crystallized in acicular or four and six-sided prisms. Contents, Lead 80.25 ; Carbonic Acid 10 ; Iron 0.18 ; Alumina 0.75 ; Lime 0.5, (WESTRUMB.) Found chiefly near Zellerfeld, on the Hartz.

4. Earthy Carbonate of Lead. *Ger.* Bleyerde.

Sometimes powdery ; sometimes aggregated, but friable ; in three colours, viz. sulphur-yellow, as at Lead Hills, in Scotland ; whitish-grey, as at Zellerfeld, on the Hartz ; and brownish-red, as in the district of Jülich.

5. Phosphate of Lead. *Ger.* Grün Bleyerz.

Generally canary-green in a variety of shades and transitions ; sometimes clove-brown, &c. ; translucent ; with greasy lustre ; usually crystallized, particularly in six-sided prisms. Specific gravity 6270. Contents of a specimen from Tschopau, Oxyde of Lead 78.4 ; Phosphoric Acid 18.37 ; Muriatic Acid 1.7 ; Oxyde of Iron 0.1. (KLAPROTH.) Found also near Clausthal, near Wanlock Head, in Scotland, and near Beresofsk in the district of Catharinburg ; the latter, according to VAUQUELIN, also containing Oxyde of Chromium.

6. Chromate of Lead. *Ger.* Roth Bleyerz.

Aurora-red, passing into Hyacinth-red : translucent ; shining ; usually crystallized, particularly in four-sided prisms, with many varieties ; streak yellow. Specific gravity 6026. Contents, Oxyde of Lead 63.96 ; Chromic Acid 36.40. (VAUQUELIN.) Found in Sandstone at Beresofsk, near Catharinburg.

7. Molybdate of Lead. *Ger.* Gelb Bleyerz.

Usually wax-yellow ; slightly translucent ; with greasy lustre ; generally crystallized, particularly in four-sided tables. Contents, Oxyde of Lead 64.42 ; Oxyde of Molybdenum 34.25. (KLAPROTH.) Found chiefly at Bleyberg, in Carinthia.

8. Sulphate of Lead. *Ger.* Vitriol Bleyerz.

Rarely limpid and transparent ; commonly translucent and

even fatal explosions.—See W. JONES's *Physiological Disquisitions*. London, 1781.

yellowish, apple-green, &c. Lustre vitreous, sometimes adamantine; fracture conchoidal; ordinarily crystallized in double four-sided pyramids; sometimes in rhomboids, &c. Specific gravity 6300. Contents, Oxyde of Lead 73; Sulphuric Acid with some Oxyde of Iron and Manganese 26. (STROMEYER.) Found at Zellerfeld, and in the Isle of Anglesea.

VIII. TIN.

Tin is very flexible and extensible, but not tenacious. It grates between the teeth, and makes a peculiar noise when bent; when rubbed or heated it emits a peculiar smell. Specific gravity 7857. It readily becomes oxydated (Flowers of Tin); is soluble in Aqua Regia; is found only in a few parts of the World, but there in large quantity. It is used, among other purposes, for silvering paper, making Bell-metal, gun-metal, for dyeing scarlet, &c.

1. Tin Pyrites. *Ger.* Zinnkies.

From Steel-grey to bronze-yellow; with metallic lustre; brittle; amorphous. Specific gravity 4350. Contents, Tin 26.5; Copper 30; Iron 12; Sulphur 30.5. (KLAPROTH.) Found only at St. Agnes, in Cornwall.

2. Oxyde of Tin. *Ger.* Zinnstein.

Brown, passing on one hand into black, on the other into hyacinth-yellow and yellowish-grey; sometimes translucent or almost transparent, as in the *Rosin Tin* from Cornwall; sometimes amorphous or in rolled masses, (*Stream Tin*) from Stream-works*; but very commonly crystallized in short four-sided prisms terminated by four-sided pyramids, and often in twin-crystals. Mean specific gravity 6900. It contains as much as 80 per Cent. of Tin. Found in the Saxon and Bohemian Erzgebirge, Cornwall, Malacca, Banca, &c.

3. Wood Tin. *Ger.* Holz-Zinn. *Cornisches* Zinnerz.

Wood-brown, hair-brown, &c.; opaque; fibrous divergent on the fracture; in small reniform masses with concentric exfoliating layers; or in wedge-shaped fragments; hard enough to

* *Stream-works* form a particular mode of mining in valleys placed between mountains containing veins, often filled to the depth of several fathoms with fragments and rounded masses, torn from these mountains and their veins. Those at Eibenstock, in the Erzgebirge, and near St. Austel, &c. in Cornwall, are very rich in Tin Ores. For an account of the former see CHARPENTIER's *Mineral. Geogr. der Churssächs. Lande.* s. 270. and of the latter *Das Bergmänn. Journal.* J. 3. B. 2. S. 143.

strike sparks with steel. Specific gravity 6450. According to KLAPROTH, contains 63.3 per Cent. of Tin. Found at Gavrigan in Cornwall.

IX. ZINC.

The colour of Zinc is intermediate between Lead and Tin; its fracture is angular and with broad fibres; its extensibility considerable. Specific gravity 7190. It melts below its red-heat, and burns in the open fire with a bluish-green flame. It is soluble in all Acids, without communicating any colour to them. Its most important use is to make Brass.

1. Blende, Sulphuret of Zinc. *Ger.* Blende.

Brown, passing on the one hand into black-brown, on the other into yellow; sometimes also into red and green; hence the names of Pitch Blende, Ruby Blende, &c.; more or less translucent; with various degrees of lustre; commonly amorphous, but also crystallized in three-sided or double four-sided pyramids, &c.; fracture spathose; many varieties, when rubbed, emit a sulphureous smell; others are phosphorescent when scratched with iron in the dark. Mean specific gravity 4000. It contains from 44 to 64 per Cent. of Zinc combined with Sulphur; also more or less Iron; sometimes also Gold and Silver, and Galena, as in the Brown Ore from the Rammeisberg. It is a very generally diffused Ore.

2. Carbonate of Zinc. Calamine. *Ger.* Calmey.

Commonly lead-grey, passing by many gradations into yellowish-brown; sometimes opaque; at others more or less translucent; usually amorphous, and as well earthy as massive; sometimes as though melted, botryoidal, reniform, or perforated, corroded, &c.; sometimes crystallized, chiefly in four-sided tables, as in Carinthia and the Altai Mountains; sometimes pseudo-morphous, as in Flintshire; when amorphous, sometimes in entire strata, as at Olkutschk, in Poland.

X. BISMUTH.

The colour of Bismuth passes from silver-white to reddish; its structure foliated; brittle. Specific gravity 9822; melts below its red-heat*; is precipitated by water from its solu-

* Bismuth, with half its quantity of Tin and of Lead, forms the fusible metal, which melts in boiling water.

tion in Nitric Acid in the form of white Oxyde. It is not very abundant in general. Used, among other things, in soldering.

1. Native.

Commonly with an iridescent tarnish; usually amorphous; sometimes reticulated; rarely crystallized in small cubes, &c.; fracture foliated. Found more commonly than the two following Species, and with them, chiefly in the Saxon and Bohemian Erzgebirge.

2. Sulphuret of Bismuth. *Ger.* Wismuthglanz.

Lead-grey; generally with a yellowish tarnish; fracture foliated, sometimes fibrous; commonly amorphous; rarely in acicular crystals attached throughout their length; or capillary; very soft; sectile; burns on coals with a sulphureous flame. Contents, according to SAGE, 60 per Cent. of Bismuth combined with Sulphur; some Iron, Arsenic, &c.

3. Plumbo-cupriferous Sulphuret of Bismuth. *Ger.* Nadelierz. Steel-grey with a yellow tarnish; lustre metallic; fracture fine granular. Contents, Bismuth 43.2; with Lead, Copper, Sulphur, &c. (JOHN.) Usually in acicular crystals attached to Milk Quartz; sometimes with native Gold. Found near Catharinburg.

4. Bismuth Ochre. Oxyde of Bismuth. *Ger.* Wismuthocher.

Yellowish, passing into greenish or grey; generally earthy; superficial or dispersed.

XI. ANTIMONY.

The colour of Antimony is intermediate between Tin-white and Silver-white; its texture foliated, radiated; brittle. Specific gravity 6702. It readily melts; volatilizes with continued heat; is imperfectly soluble in Acids; and is precipitated by Alkalies from its Nitro-muriatic solution. It is employed to impart hardness to the softer Metals, for printing types, &c.

1. Native.

Commonly tin-white; the fracture sometimes granular; sometimes foliated or conchoidal. Found near Andreasberg. Contents, Antimony 98; Silver 1; Iron 0.25. (KLAPROTH.)

2. Grey Antimony. Sulphuret of Antimony. *Ger.* Grau Spiessglaserz.

Lead-grey, Steel-grey, &c.; sometimes amorphous, and as well compact as foliated; more commonly radiated in acicular crystals; sometimes also in larger four or six-sided prisms. It melts and burns with a blue flame. Specific gravity 4200.

It contains from 70 to 80 per Cent. of Antimony, and 20 or 30 of Sulphur. Found particularly in Hungary and Transylvania.

The Plumose Sulphuret of Antimony. Ger. *Federerz*, of greyish black or lead-grey colour, consists of delicate or capillary fibres of this ore; sometimes containing Silver. It is found at St. Andreasberg, and near Naggybanya in Transylvania.

3. Nickeliferous Antimonial Ore. Ger. *Nickelspiessglaserz*. From lead-grey to tin-white; perfectly lamellar; glittering; semi-hard; fracture uneven. Specific gravity 6546. Contents, Antimony 47.75; Nickel 25.25; Arsenic 11.75; Sulphur 15.25. (KLAPROTH.) Found in Nassau.

4. Red Antimony. Ger. *Roth Spiessglaserz*. Cherry-red, with a kind of metallic lustre; amorphous, or in acicular fibrous crystals, which are sometimes aggregated in a radiated manner. Specific gravity 4090. Contents, Antimony 67.5; Oxygen 10.8; Sulphur 19.7. (KLAPROTH.) Found at Braunsdorf, near Freyberg, and in Hungary.

A peculiar foliated Variety. Ger. *Zundererz*, is found near Clausthal in drusy cavities, incrusting Quartz, Galena, &c.

5. White Antimony. Oxyde of Antimony. Ger. *Weiss Spiessglaserz*.

Passing from white into yellowish or grey; usually with nacreous lustre, and in acicular crystals aggregated in a radiated manner. In external characters, and according to KLAPROTH, in composition, it resembles the artificially prepared Oxyde of Antimony. It is found near Malaczka in Transylvania, and Przibram, in Bohemia.

6. Antimonial Ochre. Ger. *Spiessglasocher*. Usually citron-yellow; earthy; friably. Found near Freyberg, and in Hungary, usually on radiated Grey Antimony.

XII. COBALT.

Cobalt* is almost of an iron-colour, tending to steel-grey and a little to red. Its Nitro-muriatic solution forms the sympathetic ink. Specific gravity 7811. It is very difficult of fusion, and when pure, is magnetic. When roasted it forms a black powder, which combined with vitreous substances, forms Smalt, so valuable as a blue dye.

1. Tin-white Cobalt. Ger. *Weisser Speiskobalt*.

* Probably from the Bohemian word *Kowally*, containing Mineral Substances.

Tin-white ; amorphous, reticulated or dendritic ; not uncommonly crystallized, and mostly in cubes with many varieties ; less hard than the following Species. Contents, Cobalt 20.3 ; Arsenic 74.2 ; Iron 3.4. (STROMEYER.) Found at Glücksbrunn, in Gotha, Riegelsdorf, in Hesse, &c.

2. Grey Cobalt. *Ger.* Grauerspeiskobalt.

Light steel-grey ; usually amorphous ; sometimes with smooth reflecting surfaces, or reticulated ; fracture resembling that of English Steel ; very hard ; in addition to Cobalt, contains Arsenic and Iron. Found in the Saxon and Bohemian Erzgebirge.

3. Bright White Cobalt. *Ger.* Glanzkobalt.

Tin-white passing into pale red ; usually amorphous ; sometimes reniform or in small indistinct crystals. Contents, Cobalt 33.1 ; Arsenic 43.4 ; Iron 3.2 ; Sulphur 20. (STROMEYER.) Found in a few places only, as Christiana, in Norway.

4. Black Earthy Cobalt. *Ger.* Schwarzer Erdkobalt.

Black, passing into slate-blue or brownish ; sometimes powdery and friable ; sometimes indurated, botryoidal, reniform, conchoidal, &c. ; dull or glimmering ; glittering when scratched ; light ; probably containing Carbonic Acid. Found in the same places with the first Species.

5. Brown Earthy Cobalt. *Ger.* Brauner Erdkobalt.

Passing from liver-brown by many shades into yellowish-grey. Amorphous, earthy, soft ; streak with greasy lustre. Found particularly in the country of Saalfeld.

6. Red Cobalt. *Ger.* Rother Erdkobalt.

Peach-blossom-red, fading when exposed to the air ; either amorphous, earthy, dull ; or in acicular, satin-like, translucent, glittering crystals ; sometimes aggregated in a radiated manner. Contents of the latter from Riegelsdorf, Oxyde of Cobalt 39 ; Arsenic Acid 38 ; Water 23. (BUCHOLZ.) Found near Schneeberg, in the Erzgebirge.

XIII. NICKEL.

The colour of Nickel is greyish-white, passing into pale-red ; it is very hard ; very difficult of fusion ; and when pure, magnetic. It is soluble in Nitric Acid, and gives a green colour to the solution ; its Oxyde gives a blue colour to liquid Ammonia. Specific gravity—7807. It enters into the composition of the Chinese Packsong.

1. Native *. *Ger.* Haarkies.

From steel-grey to bronze yellow; in distinct capillary crystals. Besides Nickel, it contains, according to KLAPROTH, a small quantity of Cobalt and Arsenic. Found in drusy cavities in Hornstone, at Johanngeorgenstadt.

2. Copper Nickel. *Ger.* Kupfernickel.

Generally pale copper-red; amorphous; fracture obtusely angular, in facets, rarely radiated as at Riegelsdorf, in Hesse. Specific gravity 7560. Contents, Nickel, 44.2; Arsenic 54.7; with some Iron, Lead, and Sulphur. (STROMEYER.) Found commonly near White Cobalt.

3. Arseniate of Nickel. *Ger.* Nickelocher.

Apple-green; usually friable; rarely indurated, as at Regelsdorf; meagre; soiling; usually as an incrustation, and near Copper Nickel. Contents, Oxyde of Nickel 37.35; Oxyde of Iron 1.13; Arsenic Acid 36.97; Water 24.32. (STROMEYER.) It has been already mentioned that it communicates its colour to Chrysoprase, and also that Oxyde of Nickel is found in *Ærolites*, and in the Olivine-like Fossil contained in Native Iron.

XIV. MANGANESE.

Manganese is steel-grey, very hard, brittle, and difficult of fusion. Specific gravity 6850. It readily combines with Iron. It has a stronger affinity for Oxygen than any other Metal, so that it speedily becomes oxydated in the open air, forming a black powder: it is very generally diffused, and is found even in the vegetable creation. It is employed chiefly in the manufacture of white glass, and for procuring Oxygen, Oxymuriatic Acid, &c.

1. Sulphuret of Manganese. *Ger.* Braunsteinblende.

Iron-black, sometimes passing into brown; opaque; glittering; fracture uneven; small granular; dull-glimmering; semi-hard; brittle. Specific gravity 3950. Contents, Manganese 82; Sulphur 11; Carbonic Acid 5. (KLAPROTH.) Found particularly with the red Manganese Ore of Transylvania.

2. Grey Oxyde of Manganese. *Ger.* Grau Braunsteinierz.

Steel-grey, passing into Iron-black; lustre metallic, more or less vivid; sometimes amorphous, but commonly radiated,

* Native Nickel is intermixed in small proportion in Native Iron; according to HOWARD, 17 per Cent. in the Siberian, and 10 per Cent. in the South American.

and with intersecting fibres; sometimes in acicular crystals or in four-sided prisms with the extremities acuminate or pointed. The radiated kind is found near Ilfeld, in the Hartz. It contains, Black Oxyde of Manganese 90.5; Oxygen Gas 2.25; Water 7. (KLAPROTH.)

3. Black Oxyde of Manganese. *Ger.* Schwartz Braunsteinerz.

Brownish-black, iron-black, &c.; fine earthy; very soft; soiling; sometimes powdery, sooty; as in the *Black Wadd* of Derbyshire, which inflames when rubbed with oil, and is commonly used as a black oil-colour; sometimes indurated, reniform, or bush-shaped; sometimes scoriform, as in that form Caska, in the Banat. Contents of a specimen from Clausthal in the Hartz, Oxyde of Manganese 68; Oxyde of Iron 6.5; Silex 8; Barytes 1; Carbon 1; Water 17.5. (KLAPROTH.) Most of the black dendritic marks in various stones depend upon the presence of this substance.

4. Siliciferous Oxyde of Manganese. *Ger.* Roth Braunsteinerz.

Rose-red in various shades; fracture sometimes compact, sometimes foliated; dull or glittering; more or less hard. Composed, according to KLAPROTH, of Oxyde of Manganese with traces of silex. Found enclosing Gold and Tellurium at Naygag and Kapnick, in Transylvania, and Catharinburg in Siberia.

XV. ARSENIC.

The colour of Arsenic is between Tin-white and Lead-grey; its fracture scaly and foliated. Specific gravity 8308. It is one of the most volatile metals. It dissipates in the fire with a thick white vapour, having a garlic smell, and giving a white colour to Copper. Its Oxyde forms a peculiar Acid, and is soluble in water.

1. Native.

Light lead-grey, in the air becoming first yellowish, then tom-bac-brown, and at last black; commonly reniform, or with conchoidal exfoliations; very rarely reticulated, dendritic, &c.; sonorous in the small lamellæ; usually containing Iron. Found at St. Andreasberg, in the Hartz.

2. Arsenical Iron. Mispickel. *Ger.* Arsenikkies.

From silver-white to tin-white; often tarnished; usually amorphous, and as well massive as disseminated; sometimes

crystallized, chiefly in four-sided prisms ; hard ; when rubbed or struck gives out a strong garlic smell. Contents of the crystallized kind from Freyberg, Arsenic 42.88 ; Iron 36.04 ; Sulphur 21.08. (STROMEYER.)

3. Sulphuret of Arsenic. *Ger. Rauschgelb.*

Of this there are two principal kinds.

(1.) *Orpiment. Ger. Gelbes Rauschgelb.*

Usually citron-yellow ; translucent ; sometimes almost like Talc in appearance, and with nearly metallic lustre ; foliated ; soft ; flexible ; usually amorphous ; sometimes crystallized, particularly in small four-sided, indistinct, and aggregated prisms. Specific gravity 3313. Contents, Arsenic 62 ; Sulphur 38. (KLAPROTH.) Found particularly in Transylvania and the Bannat.

(2.) *Realgar. Ger. Rothes Rauschgelb.*

Aurora-red ; translucent with vitreous lustre ; streak yellow ; commonly crystallized in small four or six-sided prisms ; sometimes also incrusting other Fossils, as at St. Andreasberg, on Calcareous Spar and the drusy cavities of Zeolite. Specific gravity 3225. Contents, Arsenic 69 ; Sulphur 31. (KLAPROTH.) Found on Vesuvius and in Transylvania.

4. Oxyde of Arsenic. *Ger. Arsenikblüthe.*

Usually milk-white ; sometimes dusty ; small botryoidal or in translucent, capillary crystals with silky lustre, and aggregated in a bushy form. Soluble in Water. Composed only of Arsenic and Oxygen. On the contrary, the Pharmacolite, closely resembling it in external characters, and therefore formerly confounded with it ; contains, Arsenic Acid 45.68 ; Water 23.86 ; Lime 27.28, (JOHN,) and is soluble in Nitric Acid, but not in water. Both kinds are found at St. Andreasberg in the Hartz, and the latter particularly at Riegelsdorf, in Hesse, and Witten, in the principality of Furstenberg.

XVI. MOLYBDENUM.

Molybdenum is almost steel-grey, very brittle, and not particularly hard. Specific gravity 6963. Its Oxyde forms a peculiar Acid.

1. Sulphuret of Molybdenum. *Ger. Wasserbley.*

This Ore, which is often confounded with Graphite, is lead-grey ; lustre metallic ; texture usually curved lamellar ; greasy to the touch ; soft ; soiling ; in small lamellæ flexible. Specific gravity 4738. Contents, Oxyde of Molybdenum 60 ;

Sulphur 40. (KLAPROTH.) Found in a few places only, but in distant parts of the world; particularly near Altenberg in the Erzgebirge, Kolywan, and in Siberia.

XVII. TUNGSTEN.

The colour and Specific gravity of Tungsten have been variously stated. It is very difficult of fusion. Its Oxyde constitutes a distinct Acid, and forms a peculiar neutral salt with Ammonia.

1. Tungsten. Tungstate of Lime. *Ger.* Schwerstein.

Commonly milk-white or yellowish-white; translucent; lustre greasy; fracture almost conchoidal; amorphous, or crystallized in double four-sided pyramids. Specific gravity 6066. Contents, Tungstic Acid 77.75; Lime 17.6; Silica 3. (KLAPROTH.) Found at Schlackenwald, in Bohemia.

2. Wolfram. Tungstate of Iron.

Brownish-black; streak rusty; lustre dull; fracture foliated amorphous, or crystallized in flat six-sided prisms, and four-sided Tables. Specific gravity 7130. Contents, Tungstic Acid with Iron and some Manganese. Found in the Erzgebirge, and abundant at Dolcoath, in Cornwall. Together with Tungsten it usually occurs near Tin-stone.

XVIII. URANIUM.

Uranium, discovered in 1789 by KLAPROTH, is dark-grey, with dull, metallic lustre; soft; brittle. Specific gravity 6440. It is very difficult of fusion; is soluble in Nitric and Nitro-Muriatic Acids, and is precipitated from them by Water, in the form of a yellow Oxyde, which communicates a clear-brown colour to glass.

1. Pitch-blende. *Ger.* Pecherz. Pechblende.

Brownish-black; opaque; with greasy lustre; brittle. Specific gravity 7500. Composed of Uranium and Sulphur. Found with the following Species in the Saxon and Bohemian Erzgebirge.

2. Uran-mica. Uranite *Ger.* Uranglimmer.

From grass-green to verdigris-green, canary-green, &c.; translucent; sometimes earthy, friable, dull; at others, shining, compact, crystallized in four-sided tables. Contents, Uranium combined with Carbonic Acid, and some Copper.

3. Uran-ochre. *Ger.* Uranocher.

Commonly citron-yellow ; opaque ; earthy ; soft ; meagre ; soluble in Nitric Acid. Found upon, and in, Pitch-blende.

XIX. TITANIUM.

Titanium was detected in the Menaccanite by W. GREGOR, in 1791, and the discovery perfected by KLAPROTH in 1795. Its colour is like that of Copper ; it takes a good polish ; is brittle ; very difficult of fusion ; has a great affinity for Oxygen ; is readily soluble in Nitric, Muriatic and Sulphuric Acids ; these solutions give a white precipitate with Alkalies, and a Kermes-brown one with decoction of Galls : it is not affected, however, by Acids, either in the dry or humid way.

1. Anatase. Octahedrite.

Indigo-blue ; translucent ; lustre almost metallic ; crystallized in small elongated octahedrons. Specific gravity 3857. Found near l'Ossians, in Dauphine.

2. Titanite. *Ger.* Titan-Schörl.

Brown-red ; sometimes with almost metallic lustre ; usually acicular ; chiefly in Rock-crystal and common Quartz ; sometimes in larger four-sided, columnar crystals striated longitudinally ; particularly near Boinik in Hungary, in a compound of Mica-Slate and milk-white Quartz. *Nigrine*, which is nearly related to it, found in obtuse-angled grains and small layers in the Gold Stream-works near Olahpian, in Transylvania, and contains Oxyde of Titanium 84 ; Oxyde of Iron 14 ; Oxyde of Manganese 2. (KLAPROTH.)

3. Sphene. *Ger.* Titan-Spath.

Clove-brown ; somewhat translucent ; with greasy lustre ; crystallized in short four-sided lentiform prisms, compressed and wedge-shaped at each extremity. Sometimes in complete cross-crystals, from St. Gothard. Contents, Oxyde of Titanium 58 ; Silex 22 ; Lime 20. (ABILDGAARE.) Found at Passau, in a rock composed of Felspar, Quartz, Hornblende, &c. ; and near Arendal (Norway) in Quartz.

4. Menaccanite. *Ger.* Titan-sand.

Black ; opaque ; with dull lustre ; in small irregularly angular grains ; at first sight resembling coarse gunpowder ; sometimes magnetic. Specific gravity 4427. Contents, Oxyde of Titanium 45.25 ; Oxyde of Iron 51 ; Oxyde of Manganese 0.25 ; Silex 3.5. (KLAPROTH.) Found in the river-sand near Menaccan in Cornwall, and on Providence Island, near Botany Bay.

Iserine, a similar Titan-sand from Isergrund in Bohemia, contains, according to KLAPROTH, Oxyde of Titanium 28 ; Oxyde of Iron 72.

XX. TELLURIUM.

Tellurium, the peculiar metallic nature of which was discovered by MULLER, of Reichenstein, and confirmed by KLAPROTH, is, in colour, between lead-grey and tin-white ; its lustre metallic ; fracture foliated ; it is very brittle, and easily fusible. Its Specific gravity is only 6115 ; consequently it is one of the lightest Metals.

1. Native. Aurum problematicum.

Colour, lustre and fracture as above. Contents, Tellurium 92 ; Iron and a little Gold 7. (KLAPROTH.) Usually interspersed in the grey hornstone-like Quartz of Fatzebay, in Transylvania.

2. Graphic Tellurium. Graphic Gold. *Ger. Schriffterz.*

Tin-white ; soiling ; in small prismatic or tabular crystals, which are usually attached by one of their planes. Contents, Tellurium 60 ; Gold 30 ; Silver 10. (KLAPROTH.) Found in Quartz and Porphyry at Offenbanya, in Transylvania.

3. Black Tellurium. *Ger. Blättererz. Naygagererz.*

Lead-grey ; commonly with foliated texture ; soft ; somewhat soiling and flexible. Contents, Tellurium 32.2 ; Lead 54 ; Gold 9 ; Silver and Copper 1.8 ; Sulphur 3. (KLAPROTH.) Found near Naygag, in Transylvania, in Quartz and red Manganese.

XXI. CHROMIUM.

Chromium, discovered at the same time (1797) by KLAPROTH and VAUQUELIN, is almost lead-grey, brittle, very hard, and difficult of fusion. Its Oxyde composes a peculiar Acid.

1. Oxyde of Chrome. *Ger. Chromoher.*

Apple-green ; earthy ; streak greenish-grey ; intermixed with Quartz. Found in the Department of Sarne et Loire, usually in a kind of Breccia.

XXII. TANTALUM.

This Metal was discovered by EKEBERG, in 1802, and is of a blackish-grey colour : it is soluble in Alkalies, but not in Acids.

1. Tantalite.

Iron-black ; with almost metallic lustre ; fracture compact ; hard ; in crystals as large as a hazel-nut, apparently octahe-

drons. Specific gravity 7953. It contains, according to EKEBERG and WOLLASTON, Oxydes of Tantalum, Iron and Manganese. Found in Bavaria, in Finland, in a granitic rock, and at Massachusetts's Bay, North America. (*Columbite*.)

2. Ytthro-Tantalite.

Resembling the preceding in its external characters, but containing Oxyde of Tantalum 45; Yttria and Oxyde of Iron 55. (VAUQUELIN.) Found at Ytterby.

XXIII. CERIUM.

Discovered by HISINGER and BERZELIUS, in 1804. Greyish-white; with foliated texture; soluble in Aqua Regia, and volatilized by a strong heat.

1. Cerite, Ochroite.

Red-brown, sometimes passing into yellow; dull-glimmering; fracture splintery; semi-hard; brittle. Specific gravity 4733. Contents, Oxyde of Cerium 67; Silix 17.5; Lime 2; Oxyde of Iron 2; Water and Carbonic Acid 2. (VAUQUELIN.) Found near Ritterhütte, in Westmannland.

2. Allanite.

Black-brown; opaque; lustre pitchy; sometimes crystallized in four-sided prisms; semi-hard. Specific gravity 3500. Contents, Oxyde of Cerium 33.9; Silix 35.4; Lime 9.2; Alumina 4.1; Oxyde of Iron 25.4. (THOMSON.) Found in Greenland, in a compound of Granite and Gneiss: one of the many remarkable Fossils with which Science has been enriched by the estimable Sir C. L. GIESECKE, during his residence of nearly eight years in that country.

XXIV. IRIDIUM.

Discovered by TENNANT, in 1803. Silver-white; very hard; brittle and difficult of fusion; it is not attacked by pure Acids, and but slightly by Aqua Regia; it is soluble in the fixed Alkalies, and communicates a blue and red colour to them.

1. Native.

Viz., combined with Osmium only in separate grains among crude Platina, and also in the same manner with the seven other Metals. (See Platina.)

XXV. PALLADIUM.

Also discovered in 1803, by CHEVENIX and WOLLASTON. Light steel-grey, passing into silver-white; texture fibrous. Specific gravity 11300. Its solution in Nitric Acid is red.

1. Native.

Combined with Iridium; and also in single grains with it in Native Platina.

XXVI. CADMIUM.

First discovered in 1818, by STROMEYER, among Sulphuret of Zinc: it is almost tin-white; very soft; flexible, but tenacious; it soils the fingers considerably; is very fusible; volatilizes with heat as readily as Quicksilver. Specific gravity 8604. (*Götting. Gelehrt. Anzeig.* 1818. S. 1521.)

SECT. XVII.

OF PETRIFICATIONS.

§ 261. Oryctology, or the Doctrine of Petrifications, in a strict sense, and when properly considered and applied, forms a very important part of Mineralogy, inasmuch as it casts great light upon Geogeny, upon the various succeeding and more or less general catastrophes * which have taken place in our Globe; consequently, also, upon the relative ages of rocks, on the mode of origin of many stratified rocks, &c.; without which it is impossible to imagine a philosophical investigation of the mineralogical part of Natural History.

§ 262. The term Petrification, in its most extended sense, is applied to those animals and plants which have perished in such catastrophes, or which, subsequent to them, have been placed in such a favourable position, that their bodies, or parts of them, instead of putrifying, have, more or less, perfectly retained their original forms, and which are, farther, for the most part, impregnated with extraneous substances, stony, metallic, or bituminous.

* I have treated more fully on this matter in my *Specimen Archæologiæ telluris*. Götting. 1803. 4to.—And in *Comment. Soc. Reg. Scient. Göttingens.* Vol. XV.

Remark. Hence in strictness many objects formerly ranked among Petrifications, have no claim to the title. Such are, in particular, the *Lusus Naturæ*, which in other times afforded scope to imagination, ignorance, and credulity. For instance, the likeness of LUTHER in the Copper slate of Mansfeld, described in 1675 by VAL ALBERTI; the *lapicidina sacra* of Dr. N. LANGE at Lucerne, &c. Such, also, are objects evidently the product of art; as the cubes of baths: or, lastly, evident deceptions, as in the instance of the Petrifications of Würzburg, by which the worthy BERINGER was misled.—See his *Lithographia Wirceburgensis*. 1726. Fol. p. 5.

§ 263. From the various ways in which they are preserved, Petrifications are divided into four kinds: viz. they are found,

(1.) Merely calcined, when Bones, Shells, &c., have lost a part of their animal cement, and of their original solidity*; being in its stead impregnated with Calc Sinter, Tufa, &c., and at the same time, brittle and light. They are found, for the most part, in alluvial land, and among the Calc Sinter of the cavities and clefts of rocks.

(2.) Actually petrified, inclosed in the solid stone of stratified rocks, and usually as hard as stone itself. To this head belong most of the unknown marine animals of the primitive world, so abundant in the stratified calcareous rocks, which formed the bed of the sea in the primitive world; such also, is the petrified wood, &c., included in Hornstone and Wax-Opal.

Among the infinite variety of shells which are petrified in this way, it is rare to find the shell itself entire, as is the case in the opalescent Shell or Fire-marble of Carinthia; in most there is merely the solid mould formed within the Shell, which has itself subsequently perished. Such are most Ammonites, Hysterolites, &c. Such Petrifications are called *nuclei*, and those in which merely the impression of the external surface remains, *typolithi*, as in most of the Plants contained in Schist.

* Sometimes even the soft parts of animals are found unchanged, which however, on account of the position into which they have been thrown by catastrophe of the Globe, must be classed with Petrifications in the most extended sense of the term. Such for instance, is the Mammoth (*Elephas primigenius*), discovered in 1806, at the entrance of the Lena into the Icy Sea, with its hide and hair perfect, and of which the skeleton and stuffed skin are preserved in the Museum of the Academy of Sciences, at St. Petersburg.

(3.) Metallized, when the Petrifications are impregnated with metallic substances, particularly Iron and Copper Pyrites, Argillaceous Iron-stone, &c.

(4.) Bituminous, impregnated with Bitumen, as in Bituminous Wood, &c. To this head also belong the Insects inclosed in Amber, in so far as they are organized bodies preserved after death, and which, during some partial catastrophe of the globe, must have found a grave in this valuable substance.

§ 264. It is still more instructive and important to Geogeny, to consider Petrifications in a double point of view; viz., first, as regards the beds in which they are now found; and secondly, as regards their identity, or mere similarity, or total difference from the organized bodies of the existing Creation.

§ 265. In the first respect the height *above*, and the depth *below* the present level of the Ocean, at which Petrifications are found, is truly wonderful, and of the utmost importance as a proof of the extent of the revolutions which must have taken place in our planet. To give only a few examples in Europe, DE LAC found petrified marine animals (Ammonites) on the Savoy Alps, at an elevation of 7844 feet above the surface of the Sea*; and, on the contrary, at Whitehaven, in Cumberland, the impressions of Plants, (Ferns) are dug at upwards of 2000 feet below it. Among the most remarkable differences of the beds in which Petrifications are found are the following: they occur in

(1.) Alluvial land, commonly lying loose (unattached). This is the case with most specimens of the fossil Elephant, Rhinoceros, &c. and also the North American Mammoth.

(2.) In stalactitic rock-masses, usually in fragments cemented together by Calc-Tuff, in the manner of Breccia. Such are the prodigious Osseous Rocks, on some of the Coasts of the Mediterranean and Adriatic Seas, at Cerigo, Dalmatia, and Gibraltar.

(3.) In caves, as for instance, in the Hartz, the Forest of Thuringia, the Fichtelberg†, and also in the Carpathian Mountains.

* I am indebted to M. STROMEYER for bluish-black Ostracites, contained in brownish-grey splintery Lime-stone at Taillon, among the Pyrenees at a still more considerable height, viz., 8400 feet above the level of the Sea.

† See *Die Umgebungen von Muggendorf; ein Taschenbuch* von C. AUG. GOLDRUSS. Erlang. 1810. 12mo.

(4.) Or lastly, in Flötz Strata of Lime-stone, Bituminous Slate, Marl Slate, Gypsum, Slate Clay, Greywacke Slate, Coal Sandstone, &c.

§ 266. As regards their comparison, however, with the organized bodies of the present Creation, it is most convenient to divide the single Class, which Petrifaactions constitute, under the following three principal heads :—

(A.) *Petrificata superstitum.*

Those Petrifaactions which can be positively determined, *i. e.* which exactly resemble beings of the present Creation. Of this kind are the Fresh-water Shells, and the remains of Vegetables in the Marl-Tuff, near Göttingen*, and apparently also, most of the petrified Animals and Plants in the remarkable Strata of fetid Slate, at Oeningen, on the Lake of Constance.

(B.) *Petrificata dubiorum.*

Doubtful Petrifaactions, *i. e.* merely resembling creatures at present existing, but differing from them sometimes by their remarkable size, sometimes by various slight but uniform deviations in the form of particular parts, and sometimes, in this respect, that the now existing prototypes with which they more or less perfectly coincide, are wholly confined to distant tropical climates. In the interim, at least many Osteolites, many marine animals (those, for instance, in the calcareous Slate, at Pappenheim), and many of the insects contained in Amber, may be included in this category.

(C.) *Petrificata incognitorum.*

Petrifaactions of perfectly unknown creatures of the primitive world, *i. e.* those not even resembling, much less identical with, any being at present known. Of this kind are the Phacites, Belemnites, and many others.

§ 267. Consequently, I have arranged Petrifaactions in the first place, according to the two kingdoms of organized bodies, and the Zoolites according to the six Classes of the animal kingdom, retaining, as far as is possible, the double point of view already alluded to, in the distribution of the subdivisions.

* See Dr. WESTFELD, *über die letzte Ausbildung. der obersten Erdrinde der Gegend um Göttingen in den Götting. Gel. Anzeigen.* 1806.

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J. GESNERI, *Tractatus de Petrificatis*. Ed. 2. Lugd. Bat. 1758. 8vo.

J. E. I. WALCHS, *Steinreich*. Halle, 1762. B. 2. 8vo.

DESS, und G. W. KNORRS *Naturgeschichte, der Versteinerungen*. Nürnberg, 1755. u. f. B. 4. fol.

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ANDREA, *Briefe aus der Schweiz nach Hannover Geschrieben*. Zürich, 1776. 4to.

G. BRANDER, *Fossilia Hantoniensia*. London, 1766. 4to.

C. C. SCHMIEDEL, *Vorstellung merkwürdiger Versteinerungen*. Nürnberg, 1780. 4to.

J. PARKINSON's *Organic Remains of a former World*. London. 1804-11. 3 Vols. 4to.

G. CUVIER, *Recherches sur les Ossemens fossiles de Quadrupèdes*, &c. Paris, 1812. 4 Vols. 4to.

Petrifications from the Animal Kingdom.

I. OF MAMMALIA.

(A.) *Determinable.*

Such for instance, as the almost perfect human skeletons on the Coasts of Guadaloupe, in solid Calc Sinter with Shell Sand, and which also contain Madrepores and Shells belonging to the existing Creation*; also the bones of Foxes, Swine, &c. in the Marl Tuff of this neighbourhood.

* CH. KÖNIG on a *Fossil Human Skeleton from Guadaloupe* in the *Phil. Trans.* for 1814. Tab. 3. Also my *Specimen Archæologiæ telluris alterum*. 1816. p. 22. On the other hand, SCHEUCHZER's supposed *Homo diluvii testis*, and the paws of *Palmata*, which the late M. RIES mistook for chil-

(B.) *Dubious.*

As for instance; of a Species of Bear (*Ursus spelæus*) found in vast numbers in the caves already alluded to*.

(2.) Of a peculiar Species of the Deer Genus, the Giant Elk as it is called (*Cervus gigadteus*), dug up in Ireland particularly, and distinguished by its enormous size. In many of them, the skull is almost three feet long, and the extremities of the Antlers (weighing some hundred-weights), 14 feet from each other†.

(3.) Of the Mammoth of the Old World, a Species of Elephant (*Elephas primigenius*), the suppositious Giant's bones‡ of our ancestors; and found in great abundance in Germany§. The Ivory from the Siberian, which are dug up particularly on the coast of the Icy Sea (the *Mammontovaiakost*), resembles that now procured from the two existing Species of Elephant, and is employed for the same purposes at Archangel, Canton, and other places.

(4.) Of a Species of Rhinoceros (*Rhinoceros antiquitatis*.) It is found very commonly in company with the Elephant above mentioned, in Siberia for instance; also in Germany, as near Herzberg in the Hartz||, where five were dug up in 1750, within the compass of a mile; near Thiede in Brunswick: Burg-Tonna¶ in Gotha, &c.

dren's hands, need no notice at this period; but SPALLANZANI's confident assertion (in the 3d Vol. of *Memorie della Società Italiana*), that the osseous Breccia at Cerigo abounded with Anthropolites, has misled many modern mineralogists. Through the friendship of Mr. HAWKINS, celebrated for his Travels in the East, I have however obtained specimens of this Breccia, and after a most precise examination find that it exhibits as little of the traces of human bones, as other specimens from Gibraltar and the coasts of Dalmatia, with which it coincides perfectly in its oryctological and geological characters.

* J. C. ROSENMULLER, *Beyträge zur Geschichte fossiler Knochen*. 1. St. Leipzig, 1795. 8vo.

† L. C. F. H. F. VON WILDUNGEN *Taschenbuch für Forst und Jagdfreunde*, für 1800. s. 159.—And J. W. NEERGAARD *Beyträge zur vergleich. Anatomie*. Göttingen, 1807. 8vo. s. 127.

‡ VOIGT's *Magazin*. B. 5. St. 1. s. 16.

§ K. MERK, *Lettres sur les os fossiles d'Elephants et de Rhinoceros qui se trouvent en Allemagne*. T. 3. Darmstadt. 1783. 4to.—And CUVIER Op. cit.

|| HOLLMANN in *Comment. Soc. Scient. Göttingen*. T. 2. p. 215.—CUVIER. Op. cit. and VOIGT's *Neues Magazin*. B. 12. S. 97.

¶ See VOIGT in his *Magazine*. B. 3. St. 4. s. 2.

(C.) *Wholly unknown.*

To quote a few out of many :—

(1.) The colossal land monster of the primitive World, the North American Mammoth (*Mammut ohioticum*. *Mastodonte*. Cuv*.) the bones of which are dug on the Ohio, &c. ; and distinguished from the rest of the animal Creation of the primitive World, by the very peculiar form of its grinding teeth.

(*Abbild. Nat. Hist. Gegenst. Tab. 19.*)

(2.) The *Megatherium Americanum*†, remarkable for the enormous deformity of the Head, Pelvis, Legs, and Claws ; the bones of which are dug up in various parts of South America.

(3.) The entire Genus of *Palæotheria*, of which Baron Cuvier has discovered several Species in the Gypsum of Montmartre ; unknown animals intermediate between the Rhinoceros, Tapir, and Swine Genera.

(4.) The two extraordinary *Ornithocephali* found in the Calcareous Schist of Pappenheim, and referred to the Order Chiroptera by Professor SÖMMERING, who has accurately described them ‡.

II. OF BIRDS §.

In general rare ; the bones of Marsh Birds, however, are found in the fœtid Slate of Oeningen, and of various other kinds in the Gypsum of Montmartre.

III. OF AMPHIBIA.

(A.) *Determinable.*

For instance, Frogs and Toads in the fœtid Slate of Oeningen ||.

(B.) *Dubious.*

For instance, Tortoise-shells, of which I possess specimens from Burg-Tonna at the same spot where the bones of the du-

* REMBR. PEALE'S *Account of the Skeleton of the Mammoth*. London, 1802. 4to. CUVIER Op. cit.—And A. C. BONN, in the *Natuurlyke Verhandel der Maatsch. der Wetensch. te Haarlem*. B. 4. St. 2.

† D. JOS. GARRIGA *Descripcion del Esqueleto de un quadrupedo muy corpulento y raro*. Madrid, 1796. 4to.—And CUVIER. Op. cit.

‡ On the *Ornithocephalus priscus* and *brevirostris* in the recent Vols. of the *Deukchr. der Königl. Acad. der Wissench. zu München*.

§ See M. VON HOFF in his *Magaz. über die gesammte Mineralogie*. B. 1. s. 283.—And Baron CUVIER. Op. cit.

|| ANDREA. Op. Cit. Tab. 15. fig. 6.

bious Species of Elephant and Rhinoceros above mentioned, are found*.

(C.) *Unknown*.

Such as the enormous creature (*Lacerta gigantea* †) resembling a Crocodile, and found particularly in the Petersberg, near Maestricht ‡.

IV. OF FISHES.

Although the Petrifications belonging to this Class, Ichthyoliths, are found in the greatest abundance and variety, as well of the Species of Fish they represent, as of the materials in which they occur, most of them require a rigorous comparison and revision without prejudice before they can with certainty be referred to their proper situations in our arrangement, viz. as determinable, dubious, or unknown. It is of a very few only that such a disposition can at present be made with certainty; such for instance, as those in the fœtid Slate of Oeningen, and the *Salmo arcticus* which is found at Zuckertop, on the West Coast of Greenland, inclosed in a mummy-like state in oblong masses of Clay ‡.

The skeletons of Fishes which are found generally very well preserved in the fœtid Schist of Mount Volca, near Verona §, can in general be very positively referred to known Species. But in that case it appears remarkable, that this mountain should form a common receptacle not only for fresh water, but also for sea-fish, and that the latter should comprise creatures from the most remote parts of the Ocean; from Otaheite as well as from the Mediterranean, from the coasts of Japan, Brazil, the North-East of America, from Africa, &c. Those found in the tabular Slate from Blattenberg, in the Canton of Glaris, and in the Bituminous Clay Slate of Mansfeld and Hesse, rarely present the parts essential to their specific characters, in a manner

* See M. VOIGT, Loc. cit. Tab. 1. fig. 1.

† M. VON SÖMMERING über die *Lac. gigantea* der Vorwelt; und über den *Crocodylus priscus*: in *Denkschr. der Königl. Acad. der Wissensch. zu München*.

‡ FAUJAS ST. FOND, *Histoire Naturelle de la Montagne de St. Pierre de Maestricht*. Paris. An. 7. 4to.

§ NEHEM. GREW *Museum Reg. Soc. Lond.* Tab. 19.

|| See Count GAZZOLA's splendid *Ittiolitologia Veronese*. 1794. Gr. fol. —G. GRAYDON in the *Trans. of the Royal Irish Academy*. Vol. V. 1794. p. 281.

sufficiently distinct to admit of the determination of their Species.

The remains of Fishes found in compact Flötz Limestone, are generally only single vertebræ, bones and teeth. Of the latter sort are in particular the *Glossepetræ* belonging to the Shark Genus, and the Bufonites, many of which bear a resemblance to the obtuse teeth of the *Anarrhichas lupus*.

V. OF INSECTS.

(A.) *Determinable.*

For instance, in the Schist at Oeningen, Larvæ of Libellulæ, Noctonectæ, &c.

(B.) *Dubious.*

To this head belong most of those inclosed in Amber, as also most of the petrified Crabs (Cammarolites.)

(C.) *Unknown.*

Such are the celebrated Trilobites. (*Entomolithus paradoxus*. LINN.) *Dudley-fossil*, which are found in various places, but no where finer than at Dudley, in Worcestershire, and frequently retaining their Crab-like shell. (*Abbild. Nat. Hist. Gegenst.* Tab. 50.)

VI. OF WORMS.

All, almost without exception, from the Orders Testacea, Crustacea, and Corallia. The fossil beaks, however, found at Heineberg near Gottingen, on the Petersberg, near Maestricht, and at Bath, appear to have belonged to a Genus of Mollusca, viz. *Sepia**.

I. TESTACEA.

In countless Species; and what is particularly remarkable, including Strata of fresh-water shells alternating with those, which, according to all analogy, must have existed in the Sea†.

(A.) *Determinable.*

Apparently of Bivalves the common petrified Species of *Terebratulites*, found in stratified Lime-stone, which resembles the *Anomia vitrea*, affording an instance of regeneration in the present Creation, according to a type of the primitive world.

* *Specimen Archæologiæ telluris*. I. 1803. Tab. 2. fig. 5.

† G. CUVIER et A. BROGNIART *Essai sur la Géographie Minéralogique des Environs de Paris*, 1811. 4to.

Among Univalves, the calcined *Trochus lithophorus*, found in Piedmont, in alluvial soil.

(B.) *Dubious*.

For instance, among Multivalves the elegant *Balanites, porosus*, from Osnabrück *; and which presents an appearance of some importance in the Archæology of our planet, viz. that it not uncommonly projects in a perfect state from single, smoothly rounded Pebbles †.

Among Bivalves, the very large *Terebratulites* also found at Osnabrück ‡. And of Univalves, the calcined *Strombites*, almost a foot long, found in alluvial soil, in Champagne.

(C.) *Unknown*.

Found in great abundance in stratified Lime-stone; to mention only a few among the most remarkable:—among Bivalves;—

(1.) The opalescent *Ostracite*, in the Carinthian Shell-Marble;

(2.) The thick shelled *Ostracites pinnigenus*, found, together with the next Species, by M. DE LUC, on Mount Salève, near Geneva §;

(3.) The large and almost heart-shaped *Anomite* ||;

(4.) The *Gryphites*;

(5.) The *Hysterolites*;

(6.) The *Langue fourrée*, as it is called, from St. Onges ¶;

(7.) The Slipper-Shell of M. VON HUPSCH **;

(8.) The petrified Goat's Hoofs, as they are called, from the Blatten Lake, in Hungary ††; with many others.

Of the Univalves, some are called *polythalamia*, the Shell being divided internally by septa into chambers. Of this kind are :—

(1.) The *Phacites* or *Lenticulites*, which are covered exter-

* *Specimen Archæolog. tellur.* 1. T. 1. fig. 1.

† A kind of occurrence which the learned mineralogist, GUETTARD, doubted as far as regards Fossil Shells. See *Mem. de l'Acad. des Scienc. de Paris.* 1759. p. 204.

‡ *Specimen Archæolog. tellur.* I. Tab. 1. fig. 4.

§ DE SAUSSURE, *Voyages dans les Alpes.* Vol. I. Tab. 2. fig. 5, 6.

|| DE SAUSSURE, loc. cit.

¶ DE LUC's *Letters on the History of the Earth and of Man.* Vol. I. p. 262.

** In his *Neue in der N. G. des Nieder-Deutschlands gemachten Entdeckungen.* Frankf, 1768. 8vo. Tab. 1.

†† C. D. BARTSCH, in the *Ungrischen Magazin.* B. II. S. 135.

nally by slightly arched lamellated Shells, and consist internally of a very delicate spiral tube of considerable length, divided into several chambers. (*Abbild. Nat. Hist. Gegenst.* Tab. 40.) They are commonly as large as a Lentil, but sometimes larger. They are found in many parts of the world, and sometimes in enormous strata; in Lower Egypt, for instance, the Pyramids being chiefly composed of them.

(2.) The innumerable crowds of Ammonites.

(3.) The Orthoceratites, equally remarkable and uncommon, sometimes a foot long, and found particularly in the Duchy of Mecklenberg.

(4.) The Belemnites, (*Dactyli idæi*) among which, however, there are some Species without septa or alveoli. They form one of the most common Petrifications of Lime-stone rocks, in which they are commonly found, filled with black Swine-stone: they occur also in other Flötz strata, for instance, in the Kentish Chalk.

(5.) The Cornucopiæ of Dr. W. THOMSON, from Cape Passaro, in Sicily*.

Of Univalves without any internal septa are:—

(1.) The remarkable Muricites with their convolutions turning to the left, found on the coast near Harwich. (*Abbild. Nat. Hist. Gegenst.* Tab. 20.)

(2.) The extremely singular small Muricites *deformis* of SOLANDER, the point of which always terminates in an irregular vermiform tube†.

(3.) The large and singular Dentalites found in vast numbers in compact Lime-stone, in the Canton of Lucern‡.

(4.) The small Serpulites *coacervatus* which is found at Deister, in Hanover, aggregated in entire strata of Swine-stone§.

II. CRUSTACEA.

(1.) Among the various kinds of Echini, those in particular, which instead of prickles are beset with the Jews-stones, formerly so mysterious||.

* See WIEDEMANN'S *Archiv. für Zoologie*, &c. B. 4. S. 1. Tab. 1.—And KARSTEN, in *Magaz. der Berlin. Naturforsch. Gesellsch.* 3ter. J. 1es. Q. S. 95.

† BRANDER. *l. c.* Tab. 2. fig. 37-8.

‡ See VOIGT'S *Magazin*. B. 5. St. 1. s. 14. &c. Tab. 2.

§ *Specimen Archæolog. telluris*. I. Tab. 2. fig. 8.

|| See ANDREA *loc. cit.* Tab. 14. fig. d. p. 265.

(2.) The Encrinites ;—and (3.) The Pentacrinites, two notable kinds of Petrifications, resembling, though not identical with, the *Encrinus asteria* of the existing Creation ; consisting of a body with many arms, and attached to an articulated stalk.

In the Encrinites or Sea-lilies *, (*Abbild. Nat. Hist. Gegenst.* Tab. 60.) which are found chiefly in compact Lime-stone, the arms of the body are usually folded together, giving the whole the appearance of a head of Maize or an unblown Lily, whence their name. The stem without any branches must have been attached by its lower extremity to the bottom of the sea of the primitive world. Its vertebra-like joints, which have the shape of little mill-stones with sun-shaped marks, are generally known under the name of Entrochites, St. Cuthbert's Beads, &c., and are found in vast numbers in the Flötz Lime-stone of many places.

The Pentacrinite or Medusa-palm † (*Abbild. Nat. Hist. Gegenst.* Tab. 70.) consists of a large, many-armed, tuft-shaped body, attached to a single articulated stem without branches, and upwards of eight feet long. This remarkable Petrification was formerly found principally in bituminous marly Schist, near Boll, in the Kingdom of Wirtemberg.

The well known Asteroites are the pentagonal joints of the articulated and branched stem of a similar Petrification, not yet perfectly known.

III. CORALLIA.

(1.) Madreporites in great abundance and variety, and forming in some places genuine coral-reefs belonging to the primitive world. For instance, in compact Lime-stone and Marble, on Mount Salève, near Geneva, and on the Hartz, near Blankenburg, and Grund, &c. The very beautifully formed *Madreporites cristatus* ‡ from the latter place deserves notice, as also the remarkable small *Madreporites lenticularis* from the

* M. R. ROSINI, *Tentaminis de Lithozois ac Lithophytis prodromus.* Hamb. 1719. 4to.

S. C. HOLLMANN, *Descriptio Pentacrinitorum.* Gött. 1784. 4to.

VOIGT's *Magazin.* B. 4. St. 4. s. 1. Tab. 1.

† *Act. Acad. Palatinæ.* T. 3. P. *phys.* The Specimen containing Pentacrinites depicted in WALCH's work. T. 1. Tab. 11. is now in my collection.

‡ *Specimen Archæologiæ telluris* I. Tab. 3. fig. 12.

celebrated Perte du Rhone, (*Abbild. Nat. Hist. Gegenst. Tab. 80.*) which has given origin to many mineralogical errors.

Very fine and large Madreporites are found at Antigua, in shelly Hornstone, sometimes traversed by milk-blue Chalcedony.

Others in sandy Lime-stone, in the Petersberg, near Maestricht: in the Chalk of Kent (*Fungites*): in brown Iron Ore, and ferriferous Quartz, as *Fungites* and Screw-stones (a kind of Cubiporite?) near Rübeland, on the Hartz: the latter also near Catharinburg, in Siberia.

(2.) *Milleporites* and other delicate kinds of Coral, chiefly in the sandy Lime-stone, near Maestricht; in Flint; near Celle, in Hanover*; and in the Hertfordshire Pudding-stone.

PETRIFACTIONS FROM THE VEGETABLE KINGDOM.

In general it rarely happens that these are so perfectly preserved as to render it possible to distinguish their specific characters; which in fact is scarcely possible as regards single parts of plants, as for instance, in the case of fossil wood. The triple distinction, however, applied to animal Petrifications, is also generally applicable here.

I. IMPRESSIONS OF PLANTS AND LEAVES†.

(A.) *Determinable.*

As for instance, in the fetid Slate of OEningen.

(B.) *Dubious.*

To this head appear to belong most of the Ferns, &c., found in Shale and Argillaceous Iron-stone.

(C.) *Unknown.*

To give one instance for all; the very remarkable, enigmatical scaly impressions, sometimes branched, and often of immense size, which are found in various places, particularly in the Shale of Coal-pits, but also in Coal-Sandstone, near Edinburgh, and at Clausthal, in Greywacke and Clay-Slate.

II. FOSSIL SEEDS, FRUITS, &c.

(A.) *Determinable.*

* *Specimen alterum. fig. 7.*

† J. J. SCHEUCHZER, *Herbarum Diluvianum*. Lugd. Bat. 1723. fol.—
E. F. VON SCHLOTHEIM, *Beschreibung merkwürdiger Kräuterabdrucke und Pflanzenversteinerungen*. 1ste Abth. Gotha. 1804. 4to.

As for instance, in the fetid Slate of Oeningen, so often alluded to, in which undoubted impressions of the blossoms of a *Ranunculus* have been found.

(B.) *Dubious.*

Of this kind the Ears of Corn, &c., (as they are called,) - em tallized parts of fructification found at Frankenberg, in Silver and Copper Ores.

Also one of the most beautiful, and at the same time uncommon Petrifications, the Maggot-stone, as it is vulgarly called, found in yellowish and reddish Hornstone, at Plau, near Dresden, and resembling the Seed-capsules of a tropical *Onoclea* *.

(C.) *Unknown.*

For instance, the almond-shaped Fruit-capsules, found among the Fossil Wood of the Prussian Amber Mines †; the small Palm-nuts from the Umber-pits of Cologne, &c.

III. FOSSIL WOOD. (*Lithoxyla.*)

Most of these specimens it is very difficult, as already mentioned, to refer with certainty to any of the three divisions adopted in this arrangement.

Many, it is true, are easily *determinable*, as for instance, (though it hardly admits of being placed here,) the Birch-wood converted into Bog Iron Ore, at Kontschosero, in Olonezk.

Others, on the contrary, are certainly quite *unknown*, as in the Wood-stone of Hilbersdorf, near Chemnitz, distinguished by its uniform compact texture, without any trace of concentric layers, and also apparently having been perforated by tubes about the size of a goose-quill, and running in a parallel direction.

The remaining and more *dubious* kinds are, in general, either actually petrified, as for instance, in Lime-stone, Sand-stone, but more particularly in Wood-stone and Wood-Opal; or else still combustible, of which nature above all, is the Bituminous Wood found in enormous strata in so many parts of the Northern World. But even this is in many places impregnated with Quartz, so that it is capable of striking sparks with Steel.

* *Specimen alterum.* fig. 3, 4. in fig. 1, 2, of which, I have also represented an undoubted prickly Pericarp (in form resembling that of the *Bunias orientalis*) in oriental Chalcedony.

† The same *Specimen* &c. p. 15.

‡ FAUJAS ST. FOND, in the *Journal des Mines.* 1797. An. 5. Tab. 25.

But besides these, many kinds of Fossil Wood are intermediate between the Bituminous and the Petrified, in so far as this, that they are impregnated with Carbonate of Lime, and therefore effervesce with Acids, whilst at the same time they diffuse a resinous smell in burning; as for instance, in the Diluvial Wood, as it is called, (*Sündfluthholz*) found in Trapp, at Joachimsthal, at the depth of 150 fathoms.

Lastly, the Mineral Wood-coal deserves notice, which is found in many kinds of Stone-coal, as well as in Terras and Piperno, and sometimes (as the so called Gold-coal) with native Gold, at Verespatak, in Transylvania.

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